STAR

SEMIMONTHLY

AUGUST 8, 1966

VOLUME 4 • NUMBER 15

N66-26886—N66-28385

DOCUMENTS DEPT.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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United States Government
National Aeronautics and Space Administration
Scientific and Technical Information Division

Scientific and Technical Aerospace Reports, Volume 4, is prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by Documentation Incorporated.

Use of funds for printing this publication approved by the Director of the Bureau of the Budget June 7, 1966

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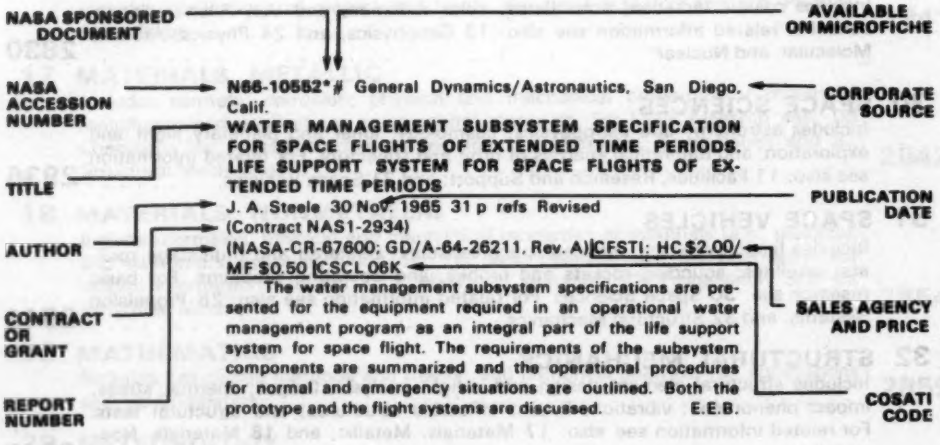
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N66-10552*# General Dynamics/Astronautics, San Diego, Calif.
CORPORATE SOURCE
TITLE
WATER MANAGEMENT SUBSYSTEM SPECIFICATION FOR SPACE FLIGHTS OF EXTENDED TIME PERIODS. LIFE SUPPORT SYSTEM FOR SPACE FLIGHTS OF EXTENDED TIME PERIODS
PUBLICATION DATE
AUTHOR
J. A. Steele 30 Nov. 1965 31 p refs Revised
(Contract NAS1-2934)
CONTRACT OR GRANT
REPORT NUMBER
(NASA-CR-67600; GD/A-64-26211, Rev. A) CFSTI: HC $2.00/MF $0.50 CSCL 06K
SALES AGENCY AND PRICE
The water management subsystem specifications are presented for the equipment required in an operational water management program as an integral part of the life support system for space flight. The requirements of the subsystem components are summarized and the operational procedures for normal and emergency situations are outlined. Both the prototype and the flight systems are discussed. E.E.B.
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VOLUME 4 NUMBER 15

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

August 8, 1966

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N66-27042*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EFFECTS OF WING PLANFORM ON THE AERODYNAMIC CHARACTERISTICS OF A WING-BODY-TAIL MODEL AT MACH NUMBERS 1.57, 2.16, AND 2.87

Royce L. Mc Kinney and Lloyd S. Jernell Washington, NASA, Mar. 1965 46 p refs

(NASA-TM-X-1065) CFSTI: HC $3.00/MF $0.50 CSCL 01A

An investigation has been made in the Langley Unitary Plan wind tunnel to determine the effects of a series of wing leading- and trailing-edge modifications on the longitudinal and lateral aerodynamic characteristics of a swept-wing configuration. The tests were conducted at Mach numbers of 1.57, 2.16, and 2.87 and at a Reynolds number of 3×10^6 per foot. The results indicate that progressively filling in the wing trailing-edge notch improved the pitching-moment linearity and decreased the center-of-pressure shift with Mach number. Adding either leading- or trailing-edge extensions to the basic wing resulted in an increase in maximum lift-drag ratio. An abrupt nonlinear variation of effective dihedral with angle of attack that occurred for the wings with large trailing-edge cutouts was essentially eliminated when the trailing-edge notch was filled in. Adding either leading- or trailing-edge extensions to the basic wing resulted in a substantial improvement in directional stability at a constant lift coefficient. Author

N66-27074*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

RESUME OF RECENT PARAWING RESEARCH

Francis M. Rogallo, William C. Sleeman, Jr., and Delwin R. Croom [1965] 38 p refs Presented at the course on Aerodyn. Deceleration, Minn. Univ., Minneapolis, 8 Jul. 1965

(NASA-TM-X-56747) CFSTI: HC $2.00/MF $0.50 CSCL 01A

This report summarizes recent research on paragliders and parawings. This research is concerned with many different types of parawing configurations and it is shown how these separate investigations are related and how each type of configuration fits into the overall spectrum of aeroflexible lifting surfaces. Some recent experimental results on wings of current interest are reviewed, and important problem areas and possible design trade-offs are discussed. The most recent parawing work being conducted is on the completely flexible-limp paraglider (wing-type gliding parachute). A summary of test results on this paraglider, obtained in the 17 foot test section of a 300 mph 7 x 10 foot wind tunnel, is presented. A combined list of references and bibliography of parawing publications is included. R.N.A.

N66-27081*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A SYSTEMATIC STUDY OF THE FACTORS CONTRIBUTING TO POST-STALL LONGITUDINAL STABILITY OF T-TAIL TRANSPORT CONFIGURATIONS

Robert T. Taylor and Edward J. Ray [1965] 30 p refs Presented at the AIAA Aircraft Design and Technol. Meeting, Los Angeles, 15–18 Nov. 1965

(NASA-TM-X-56882) CFSTI: HC $2:00/MF $0.50 CSCL 01A

A wind-tunnel research program has been undertaken by the National Aeronautics and Space Administration to study the aerodynamic characteristics of T-tail aircraft at high angles of attack. The program was designed to show the effect on longitudinal stability and control of several configuration variables encompassing horizontal-tail size, vertical position, planform, and incidences; nacelle size, location, and pylon effects; wing section, stall-control devices, flaps, aspect ratio, and sweep; fuselage cross-section size, cross-section shape, and forebody length. Results of this program are presented and analyzed to serve as a preliminary design guide. Author

N66-27216# Royal Aircraft Establishment, Bedford (England).

CALIBRATION OF THE FLOW IN THE MACH 4 WORKING SECTION OF THE 4 FT X 3 FT HIGH-SUPERSONIC-SPEED WIND TUNNEL AT R.A.E., BEDFORD

D. R. Andrews and C. S. Brown London, Min. of Aviation, May 1962 28 p refs

(RAE-TN-AERO-2820) CFSTI: HC $2.00/MF $0.50

Mach number and flow angle distributions in the working section of the Mach 4 nozzle of the 4-ft x 3-ft high-supersonic-speed wind tunnel are presented for a range of total pressure and humidity. Author

N66-27223*# Consultants and Designers, Inc., Arlington, Va.

ANALOGY OF A HYPERSONIC FLOW PAST THIN BLUNT BODIES WITH AN EXPLOSION [OB ANALOGII S VZRYVOM GIPERZVUKOVOGO OBTEKANIYA TONOKOGO PRITUPLENNOGO VPEREDI TELA]

G. C. Chernyy Washington, NASA, Aug. 1963 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Gidromekhan. (Moscow), v. 151, no. 2, p 302–305
(Contract NAS5-2078)
(NASA-TT-F-8619; ST-10034) CFSTI: HC $1.00/MF $0.50 CSCL 01A

A discussion is given of the analogy of hypersonic flow past a thin, blunt body with a strong cylindrical charge explosion. The establishment of the foundations of this theory was marked by the ascertainment of the similitude law at hypersonic flow past thin bodies, and as an example of similitude of various cases of flow, similitudes are presented of pressure distribution on cones with different aperture angles and of different head shape in original and similitude variables. It is demonstrated that for the asymptotic description of flow past thin, blunted bodies, the result obtained does not contradict the analogy with an explosion. C.L.W.

N66-27433*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF THE BOUNDARIES OF AN INCOMPRESSIBLE FLUID FLOW ON THE UNSTEADY AERODYNAMIC CHARACTERISTICS OF A PROFILE
D. N. Gorelov May 1966 11 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk: Mekhan. i Mashinostr. (Moscow), no. 5, 1965 p 157–159
(NASA-TT-F-10112) CFSTI: HC $1.00/MF $0.50 CSCL 01A

Influence of flow boundary effects on airfoils within linear theory is discussed. Solid wall, free liquid or mixed boundaries are compared. Movement in and out of phase is evaluated. The value of the Strouchal number is discussed. Author

N66-27494*# National Aeronautics and Space Administration, Washington, D. C.
FRICTION AND WINDAGE LOSSES IN ROTOR BLADE ASSEMBLIES OF RADIAL-FLOW TURBINES OF HELICOPTER AND TRANSPORT GAS TURBINE POWER PLANTS [O POTERYAKH TRENIYA I VENTILYATSII V RABOCHIKH VENTSAKH RADIAL'NYKH TURBIN VERTOLETNYKH I TRANSPORTNYKH GTU]
N. F. Galitskiy May 1966 16 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Aviats. Tekh. (Kazan), v. 7, no. 4, 1964 p 60–66
(NASA-TT-F-10118) CFSTI: HC $1.00/MF $0.50 CSCL 01A

Friction and windage losses in blade rims of radial-flow turbines, idling in forward and reverse direction and at variable rpm, are discussed. Results of experiments with turbine blades mounted to the shaft of a high-frequency 9-kw motor in atmospheric air, in sealed and unsealed casings, are applied to aircraft gas turbines. Formulas are given for calculating the power expenditure, allowing for ventilation of the medium and for boundary friction, in single- and multistage radial-flow turbines. Windage losses were reduced by modified layout of interblading shrouds without change in radial clearance. Author

N66-27505*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLIGHT-MEASURED GROUND EFFECT ON A LOW-ASPECT-RATIO OGEE WING INCLUDING A COMPARISON WITH WIND-TUNNEL RESULTS
L. Stewart Rolls and David G. Koenig Washington, NASA, Jun. 1966 30 p refs
(NASA-TN-D-3431) CFSTI: HC $1.00/MF $0.50 CSCL 01A

The ground effect on an aircraft with a low-aspect-ratio Ogee wing was determined in flight and was compared with results for similar configurations determined in three wind tunnels. The maximum flight increments in lift coefficient and elevon angle for trim in ground proximity (ΔC_L=0.18 and $\Delta\delta_e$=4° trailing edge down) agreed with the values measured in all the wind tunnels. These ground effect increments did not affect the pilot's ability to make successful landings. Author

N66-27568# Polytechnic Inst. of Brooklyn, N. Y. Dept. of Aerospace Engineering and Applied Mechanics.
RESEARCH STUDIES CONDUCTED AT THE POLYTECHNIC INSTITUTE OF BROOKLYN AEROSPACE INSTITUTE
Robert J. Cresci and Martin H. Bloom Oct. 1965 14 p refs
(Contract AF 49(638)-1391)
(PIBAL-898; AFOSR-66-0572; AD-630557) CFSTI: HC $1.60/MF $0.50

The report presents a brief review of a series of studies performed in connection with the flow over slender configurations at high Mach numbers and low Reynolds numbers. Two particular problem areas were emphasized in this research; these are, the near wake of axisymmetric bodies and viscous–inviscid interactions that occur along the intersection of planar surfaces aligned with the stream. The results of both theoretical and experimental studies related thereto are presented. Author (TAB)

N66-27610# Princeton Univ., N. J. Gas Dynamics Lab.
AERODYNAMIC DRAG AND HEAT TRANSFER FOR FLOW PAST TWO-DIMENSIONAL BODIES AT HIGH KNUDSEN NUMBERS
D. Roger Willis and P. Taub Wright-Patterson AFB, Ohio, ARL, Jan. 1966 44 p refs
(Contract AF 49(638)-1271; Nonr-22(45))
(ARL-66-0007; AD-631598) CFSTI: HC $2.00/MF $0.50

Using the integral iteration method, theoretical results are obtained for aerodynamic drag and heat transfer in the nearly free molecular regime. The geometries considered are: circular cylinders, inclined flat plates, and wedges, all two-dimensional. Perturbation to the free molecular results are obtained correct to order (1/Kn) *ln* Kn only (Kn is the Knudsen number). The free-stream speed ratio is greater than two and the body temperatures range from free stream to recovery. The results are similar to those obtained previously for a normal flat strip, except that for small angle wedges and flat strips at small angles of attack, the drag coefficient is predicted to exceed the free molecular value. Author (TAB)

N66-27620# Princeton Univ., N. J. Gas Dynamics Lab.
PRELIMINARY STUDIES OF THE FLOW AROUND TWO-DIMENSIONAL BODIES AT HIGH MACH NUMBERS AND LOW REYNOLDS NUMBERS
S. M. Bogdonoff and I. E. Vas Wright-Patterson AFB, Ohio, ARL, Jan. 1966 31 p refs *Its* Rept.-754
(Contract AF 49(638)-1271)
(ARL-66-0006; AD-631474) CFSTI: HC $2.60/MF $0.50

The studies were primarily concentrated on the leading edge region where the shock wave and the viscous region caused by the body itself interact. The studies were carried out at a mach number of about 24, in a hot nitrogen wind tunnel operating at stagnation pressures of 2000–5000 lb/sq in. and at stagnation temperatures to 2700°K. Results were obtained for values of the interaction parameter from 60–250. In this region, results were obtained on a flat plate with leading edge thicknesses which varied from

a fraction of a mean free path to hundreds of mean free paths. The detailed pressure distributions obtained over the body seemed to indicate significant deviations from the strong interaction theory, falling considerably below the theoretical results. Exploratory studies of the details of the flow field in this region indicate that the simple one-dimensional Rankine-Hugoniot equations cannot be used across the shock wave. A new tool for study of this region indicates shock profiles which show the changes in the structure of the phenomenon as one approaches the leading edge. Author (TAB)

N66-27672# Syracuse Univ. Research Inst., N. Y. Dept. of Mechanical and Aerospace Engineering.
INTERACTION OF CONCENTRATED VORTICITY WITH AN ADVANCING SHOCK AND EXPANSION WAVE Final Report
Darshan S. Dosanjh Mar. 1966 12 p refs
(Grants DA-ARO(D)-31-124-G210; DA-ARO(D)-31-124-G615) (ME-931-1256-6603-F; AROD-3242-6; AD-631286) CFSTI: HC $1.00/MF $0.50

Results of the experimental and analytical investigations on (1) interaction of an advancing shock front and a starting vortex flow field, (2) interaction of an advancing shock front and a vortex street flow field and (3) interaction of a rectilinear circular vortex flow field with a progressing expansion wave, are summarized. The experimental phase of these investigations was conducted in a shock tube and the transient interaction data were recorded using spark shadowgraph, schlieren and interferometric techniques. The observed distortion of the advancing reflected shock front, the transmitted (interacted) vortex flow field and the characteristics of a growing acoustic wave front generated as a result of reflected shock-vortex interaction were recorded and analyzed. Theoretical analyses of (a) generation of sound front due to shock-vortex interaction (b) the non-steady interaction of a rectilinear circular flow field with an advancing expansion wave, were accomplished. Author (TAB)

N66-27673# Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
DERIVATION OF ROTOR BLADE GENERALIZED AIR LOADS FROM MEASURED FLAPWISE BENDING MOMENT AND MEASURED PRESSURE DISTRIBUTIONS Final Report, Jun. 1964-Sep. 1965
Frank A. Du Waldt and Irving C. Statler Mar. 1966 60 p refs
(Contract DA-44-177-AMC-198(T))
(CAL-BB-1959-5-1; USAAVLABS-TR-66-13; AD-631494) CFSTI: HC $5.60/MF $0.75

A limited study of methods of deducing generalized air loads acting on a helicopter rotor blade or a propeller blade from bending-moment measurements is presented. A new set of basic functions called 'orthonormal-moment distributions' is proposed as the best set for fitting the moment data. The blade-tip deflections computed from pressure distributions measured on an H-34 helicopter rotor in steady level flight at 112 knots are compared with tip deflections derived by four methods based on use of measured bending-moment distributions. The degree of agreement between quantities obtained from the pressure distributions and those obtained from the moment distributions is encouraging but not satisfactory. Neither the lift nor the moment distributions were measured with sufficient accuracy for the purposes of the study. Deficiencies in the accuracy of the measurements and in the accuracy of the description of the blade mass and elastic characteristics obscure any meaningful differences between the various methods of operating on the moment data. Author (TAB)

N66-27716# Naval Ordnance Lab., White Oak, Md.
STATIC WIND TUNNEL TESTS OF THE M823 RESEARCH STORE WITH SPLIT-SKIRT STABILIZERS
Frank J. Regan, Mary E. Felsui, and John E. Homes 12 Jan. 1966 121 p refs
(NOLTR-61-89; Aerodynamics Res. Rept.-160; AD-631796) CFSTI: HC $4.00/MF $0.75

The M823 configuration is an instrumented free fall store used in bomb research programs. This report presents the results of static wind tunnel tests for the basic forebody with split-skirt tail stabilizers attached. Author (TAB)

N66-27731*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
QUASI-SLENDER BODY THEORY FOR SLOWLY OSCILLATING BODIES OF REVOLUTION IN SUPERSONIC FLOW
Max F. Platzer and Gilbert H. Hoffman Washington, NASA, Jun. 1966 62 p refs
(NASA-TN-D-3440) CFSTI: HC $3.00/MF $0.75 CSCL 01A

An analysis is presented which accounts for body shape and Mach number dependence of the aerodynamic forces on slowly oscillating pointed bodies of revolution in supersonic flow. By using body-fixed coordinates, the first order velocity potential is expanded in an elementary fashion for small radial distances from the body. This expansion is equivalent to the Adams-Sears expansion technique using Laplace or Fourier transforms. Analytical closed-form expressions for the stability derivatives are obtained. These results are valid to second-order in terms of Mach number and body thickness ratio. Three specific body shapes are analyzed in detail: a cone, a convex parabolic ogive, and a concave parabolic ogive. Numerical results for four stability derivatives are presented to illustrate their dependence on Mach number and body thickness ratio. Comparisons with other theories are given, and the range of validity of the present results is discussed. Comments on application of quasi-slender-body theory to other body shapes are made. Author

N66-27733*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
EFFECT OF BODY CROSS SECTION AND WIDTH-HEIGHT RATIO ON PERFORMANCE OF BODIES AND DELTA-WING-BODY COMBINATIONS AT MACH 6.9
Allen H. Whitehead, Jr. Washington, NASA, Jun. 1966 27 p refs
(NASA-TN-D-2886) CFSTI: HC $1.00/MF $0.50 CSCL 01A

An investigation of the aerodynamic characteristics of bodies and wing-body combinations with triangular, rectangular, and elliptical body cross-sectional shapes and with body width-height ratios of 2 and 3 was conducted at a free-stream Mach number of 6.9 and a Reynolds number based on length of 1.4×10^6. The two delta wings tested in combination with these bodies had leading-edge sweep angles of 70° and 75°. All configurations were tested in both flat-top and flat-bottom orientations. The results show that for either bodies alone or wing-body combinations the possibility of an increase in the maximum lift-drag ratio $(L/D)_{max}$ with an increase in width-height ratio depends on the cross-sectional shape and the orientation (flat top or flat bottom) of the configuration. For the flat-top wing-body combinations, neither the small increase in width-height ratio nor the change in cross-sectional shape from the basic conical to a triangular, rectangular, or elliptical wing-body combination produces any significant increase in $(L/D)_{max}$. In contrast, for the flat-bottom wind-body combinations, body

cross-sectional deviations from the conical body in some instances are shown to provide higher values of $(L/D)_{max}$. Author

N66-27792# Institute of Modern Languages, Inc., Washington, D. C.
INCREASING THE EFFICIENCY OF TURBINE EXHAUST PIPE [POVYSHENIE EFFECTIVNOSTI VYCHLOPNYKH PATRUBKOV TURBIN]
D. I. Morozov Apr. 1966 12 p refs Transl. into ENGLISH from Energomashinostr. (Moscow), no. 5, 1965 p 35-37
(Contract DA-44-009-AMC-1563(T))
(AERDL-T-1834-66; TT-66-61030; AD-631172) CFSTI: HC $1.00/MF $0.50

The two spirals of the helix—on the left and right sides—create two circulations of opposing direction, which are transmitted into an axially radial diffuser and lead to the formation, on the larger part of the circumference, of a nonradial, axially assymmetrical flow discharge from the diffuser. As a result, the effective degree of the expansion of the diffuser is diminished, and the pressure increase in it is reduced. Therefore, for a given exhaust area of the helix, it is more efficient to increase the transverse radial dimensions of the helix at the expense of the axial dimensions and thus to bring velocity field at the diffuser outlet closer to the radial direction with axial symmetry. TAB

N66-27819# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
RAMJET TECHNOLOGY. CHAPTER 10: PRELIMINARY DESIGN FOR SUPERSONIC FLIGHT
James H. Walker Feb. 1966 100 p
(Contract NOw-62-0604-c)
(TG-610-10; AD-630827) CFSTI: HC $3.00/MF $0.75

This chapter is concerned with engine selection and optimization for supersonic flight, in particular, the factors influencing the application of the ramjet engine. It is possible, for preliminary design and engine comparison purposes, to reduce a large number of supersonic flight variables to a relatively few terms that describe the airframe and powerplant and that may be readily estimated. These parameters are valuable in outlining general regions of interest, and they furnish considerable insight into various problems in application. Although the primary emphasis throughout the chapter is on these general fundamental design parameters, the three specific configurations of ramjets are discussed. Finally, a comparison of ramjets and rocket powerplants is made. This TG is one of a series of reports representing individual Chapters of a forthcoming book entitled 'Ramjet Technology. Author (TAB)

N66-28001# Aeronautical Research Council (Gt. Brit.).
MEASUREMENTS OF THE DIRECT PITCHING-MOMENT DERIVATIVES FOR THREE WING PLANFORMS AT HIGH SUBSONIC SPEEDS
J. B. Bratt, W. G. Raymer, and J. E. G. Townsend London, HMSO, 1965 41 p refs Supersedes ARC-16267
(ARC-R&M-3419; ARC-16267) CFSTI: HC $2.00/MF $0.50

Measurements of the direct pitching damping and stiffness derivatives for a delta and two swept wing planforms made in the N.P.L. 9-1/2 in. High Speed Tunnel are discussed, and results for the delta are compared with theory. Experiments to investigate the cause of loss of damping at low frequencies obtained in earlier tests are also described, and the effect on derivative measurements of random oscillatory flow disturbances is examined. Author

N66-28003# Aeronautical Research Council (Gt. Brit.).
A ROLL-BALANCE FREE-FLIGHT TEST VEHICLE FOR THE MEASUREMENT OF AILERON ROLLING POWER AND ROLL DAMPING AT M=0.8 TO 2.5
K. J. Turner London, HMSO, 1965 24 p refs
(ARC-CP-679) CFSTI: HC $1.00/MF $0.50

The existing roll-balance technique for measuring roll damping has been extended for use at higher Mach numbers and also adapted for the direct measurement of aileron rolling-moment. Two test vehicles have been flown successfully, each carrying a model of a proposed aircraft design; one was used to obtain ϵ_p and the other ϵ_δ. Results were obtained over the speed range M=0.8 to 2.2. Author

N66-28014*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF WING PLANFORM ON THE AERODYNAMIC CHARACTERISTICS OF A WING-BODY-TAIL MODEL AT MACH NUMBERS 3.96 AND 4.63
Maurice O. Feryn Washington, NASA, Jun. 1966 27 p refs
(NASA-TM-X-1242) CFSTI: HC $1.00/MF $0.50 CSCL 01A

An investigation has been conducted in the Langley Unitary Plan wind tunnel to determine the effects of several wing leading- and trailing-edge modifications on the aerodynamic characteristics of a wing-body-tail model at Mach numbers of 3.96 and 4.63. Tests were made with and without a vertical tail. The tests were conducted at angles of attack from about $-2°$ to $19°$ for angles of sideslip of about $0°$ and $5°$. The Reynolds number per foot was 3×10^6 (per meter, 9.84×10^6). The data are presented without analysis. Author

N66-28085# Northrop Corp., Hawthorne, Calif. Norair Div.
AN ANALYTIC APPROACH TO THE PROBLEM OF INVISCID SUPERSONIC FLOW PAST BLUNT BODIES
H. C. Kao Sep. 1965 55 p refs
(NOR-65-239)

A method is presented for obtaining closed form solutions for blunt bodies in the supersonic stream of an ideal gas. The solutions are written in terms of power series with elementary functions as their coefficients. These solutions are approximate, but the approximation is rational, i.e., higher approximations can in principle be obtained indefinitely. Some of these higher approximations have been calculated. Several examples are presented with varied free-stream conditions and prescribed body shapes. They are compared with those computed by a standard numerical procedure and with the available experimental measurements. The agreement is very good. Author

N66-28092# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Porz (West Germany).
A METHOD FOR NUMERICAL CALCULATION OF VELOCITY AND PRESSURE DISTRIBUTIONS AT POINTED BODIES OF REVOLUTION. PART I: THE SUPERSONIC AXISYMMETRICAL FLOW ON SURFACES OF SLENDER POINTED BODIES [VERFAHREN ZUR NUMERISCHEN BERECHNUNG DER GESCHWINDIGKEITS- UND DRUCKVERTEILUNG AN VORN SPITZEN ROTATIONSKORPERN BEI AXIALSYMMETRISCHER ANSTROMUNG. I. TEIL: DIE UBERSCHALLSTROMUNG UM SCHLANKE KORPER]
Christa Oberender Apr. 1966 34 p refs In GERMAN; ENGLISH summary
(DLR-FB-66-23; DVL-488) CFSTI: HC $2.00/MF $0.50

A method for numerical calculation of the velocity and pressure distributions at slender pointed bodies in axisymmetrical supersonic flow is designed on the basis of a known analytical method by F. Keune. It can be performed with desk

calculating machines and does not require knowledge of the theoretical background. This method is demonstrated by a simple example; an appendix contains the necessary tables.
Author

N66-28103# Royal Aircraft Establishment, Farnborough (England).
THE FLYING QUALITIES OF HELICOPTERS WITH HINGELESS ROTORS [FLUGMECHANISCHE BESONDERHEITEN DES GELENKLOSEN HUBSCHRAUBERROTORS]
G. Reichert Jan. 1966 35 p refs Transl. into ENGLISH of Bolkow Rept. no. FM-315-0
(RAE-LIB-TRANS-1147) CFSTI: HC $2.00/MF $0.50

On helicopters with hingeless rotors it is possible to obtain very large moments from the rotor by means of the blade controls. These increased rotor moments depend on the stiffness of the blade roots and of the blades themselves. An increase of control power is basically desirable, provided at the same time it is possible to increase the rotor damping in order to avoid excessive control sensitivity. With the increase of control is an associated increase of mode coupling. As a result of its ability to transfer very large moments from the rotor to the fuselage the hingeless helicopter is very sensitive to external disturbances such as gusts. For these reasons the design of hingeless rotors, especially with regard to their stiffness characteristics, must be considered with great care. With a very stiff rotor the design should make provision for the effects of rotor control and gusts to be limited yet alloy rotor damping to be retained. Such an alleviating device for control and gust effects can be combined with a rotor stabilizer or flight director.
Author

N66-28128# Norges Tekniske Hoegskole, Trondheim.
DRAG AND FLUCTUATING TRANSVERSE FORCE ON A CYLINDER IN NATURAL WIND
Martin Jensen and Ivar Holand Copenhagen, Danish Tech. Press, 1965 16 p
CFSTI: HC $1.00/MF $0.50

Drag forces and fluctuating transverse forces were measured in natural wind on a tower that fairly well approximates a circular cylinder. On the basis of the test results the following values may be predicted for a cylinder constructed of painted steel plates in natural wind, for Reynolds' numbers between 5×10^5 and 20×10^5: (1) the drag coefficient C_D is 0.71; (2) the nondimensional frequency of fluctuating transverse force, the Strouhal number S, is 0.25; and (3) the coefficient of fluctuating transverse force C_K is of the order of magnitude 0.05, but somewhat larger values must be expected.
Author

N66-28169# Royal Aircraft Establishment, Farnborough (England).
ON THE CALCULATION OF THE AERODYNAMIC INTERFERENCE OF SYSTEMS OF BODIES IN AN IDEAL FLUID [O RASCHETE AERODINAMICHESKOI INTERFERENTSII SISTEMY TEL V IDEAL'NOI ZHIDKOSTI]
D. N. Gorelov Feb. 1966 19 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk: Mekh. i Mashinostr. (Moscow), v. 5, 1964 p 33-38
(RAE-LIB-TRANS-1154) CFSTI: HC $1.00/MF $0.50

Linearized potential theory is applied to a system of separate bodies. It is assumed that the velocity potential around each body in isolation can be obtained. The velocity potential at a point in the system is obtained as the sum of the velocity potentials due to the bodies in isolation. Satisfying the condition that there is no flow across the solid boundaries leads to a set of linear equations which in general require a computer for solution. The method has been applied to the particular case of an oscillating biplane.
Author

N66-28175# Aeronautical Research Council (Gt. Brit.)
OSCILLATORY AERODYNAMIC FORCES IN LINEARIZED SUPERSONIC FLOW FOR ARBITRARY FREQUENCIES, PLANFORMS AND MACH NUMBERS
D. J. Allen and D. S. Sadler London, HMSO, 1965 78 p refs Supersedes ARC-25108; ARC-25109
(R&M-3415; ARC-25108; ARC-25109) CFSTI: HC $3.00/MF $0.75

A method is described of performing a numerical integration to solve the integral equation connecting downwash and velocity potential in linearized unsteady supersonic flow. Supersonic and subsonic leading edges and wakes are dealt with, and some practical results are given. By using this approach, a sufficiently general computer programme could deal accurately with kinked and curved edges.
Author

N66-28200# Ministry of Aviation, Pinner (England). Technical Information and Library Services.
INCREASING THE EFFICIENCY OF TURBINE DELIVERY SYSTEMS [POVYSHENIE EFFEKTIVNOSTI VY KHLOPNYKH PATRUBKOV TURBIN]
D. I. Morozov Apr. 1966 15 p refs Transl. into ENGLISH from Energomashinostr. (Moscow), v. 5, 1965 p 35-37
(TIL/T-5661) CFSTI: HC $1.00/MF $0.50

A mathematical analysis of turbine diffusers and delivery systems and means of increasing their efficiency by the introduction of an involute volute and a peripheral grid to ensure a radial outflow from the diffuser without disruption of flow is presented. Assessment of the losses in the diffuser and volute and a mathematical evaluation of the optimum rate of expansion, based on the development of the overall radial dimensions and the effective outlet section of the volute is described. It is shown that the design principles described in the paper can be recommended for increasing the efficiency of turbine delivery systems.
Author

N66-28209# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).
A STUDY OF THE BOW SHOCK INDUCED BY SECONDARY INJECTION INTO SUPERSONIC AND HYPERSONIC FLOWS
J. L. Evers 1965 68 p refs
(TN-29) CFSTI: HC $3.00/MF $0.75

The flow pattern resulting from perpendicular injection of a gas from a flat plate into free stream flows at Mach numbers ranging from 2.2 to 7 has been experimentally studied, with a primary interest in determining the validity of the assumption that the blast wave theory predicts the shape of the resulting bow shock wave. It has been found that by considering the effect of origin shift, the shock shape can be predicted with considerable accuracy by the second order blast wave solution.
Author

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N66-27188*# National Aeronautics and Space Administration, Washington, D. C.

LANDING GEAR FOR NOSE-WHEEL EQUIPPED PLANES [VELIVOLO CON CARELLO DI RUOTA DI PRUA]

Nov. 1963 7 p Transl. into ENGLISH from Italian patent no. 409389, 11 Feb. 1945

(NASA-TT-F-8579) CFSTI: HC $1.00/MF $0.50 CSCL 01C

An Italian invention eliminates lateral displacement during landing, takeoff, and taxiing of airplanes on restricted runways in crosswinds, or during takeoff obliquely or perpendicularly to the wind. The problem consists of preventing the generation of an aerodynamic moment by a gust of crosswind with the consequent turning of the airplane around the guide wheels. The desirable condition is attained if the fixed landing gear of the airplane is placed so that the center of gravity is located in front of the principal wheels' point of contact with the ground, and the point of application of the lateral aerodynamic thrust falls on or slightly behind the geometric axis of these principal wheels. R.L.K.

N66-27220*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

SOME PARAMETERS AFFECTING THE PERFORMANCE OF PNEUMATIC TIRES ON WET PAVEMENT

Trafford J. W. Leland [1965] 29 p refs Presented at Stapp Car Crash Conf., Minneapolis, 20-22 Oct. 1965

(NASA-TM-X-56880) CFSTI: HC $2.00/MF $0.50 CSCL 01C

This paper discusses some of the important details of tire tread design, and presents some test results showing how tread design parameters can delay the build-up of hydrodynamic pressure in the tire footprint area and improve braking and cornering traction on wet or flooded pavement surfaces. It is also shown how minor differences in pavement texture can be of extreme importance in providing good traction under wet conditions, and a proposed technique for measuring surface roughness and predicting the wet friction level of a given pavement texture is discussed. A brief summary of current research on tire hydroplaning is included. Author

N66-27313*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

WIND-TUNNEL INVESTIGATION OF SONIC-BOOM CHARACTERISTICS OF A DELTA-WING-BODY COMBINATION AT MACH NUMBERS OF 1.41 AND 2.01

Odell A. Morris Washington, NASA, Jun. 1966 21 p refs (NASA-TN-D-3455) CFSTI: HC $1.00/MF $0.50 CSCL 01A

An investigation has been conducted in the Langley 4- by 4-foot supersonic pressure tunnel at Mach numbers of 1.41 and 2.01 to determine the sonic-boom characteristics of a delta-wing-body model. Pressure signatures were measured for the model with the wedge-shaped body both above and below the wing. Results of the tests showed that the measured adjusted maximum pressure-rise values over the positive lift range tested were larger for the low-wing model than for the high-wing model. Comparison of the experimental and theoretical results showed good agreement which indicates that the large lift interference effects produced by the wedge-shaped body can be evaluated theoretically to obtain reasonable estimates of the sonic-boom overpressures. Author

N66-27577# Army Transportation Research Command, Fort Eustis, Va.

SUPPLEMENTARY STUDY OF DESIGN FACTORS IN AIR DELIVERY FOR CV-7 CARIBOU AIRCRAFT

R. D. H. Jones Aug. 1964 34 p ref

(TRECOM-TR-64-46; AD-608188) CFSTI: HC $2.00/MF $0.50

A study was made of the extraction of loads by parachute from the CV-7 Caribou aircraft. Two FORTRAN programs are included to show the calculation of the maximum safe envelope for the loads; various conditions with a wide range of adjustable parameters are considered. In the programs, the parameters may be set as data to simulate any values, such as those for the extractive force of the ejection parachute, for the coefficient of sliding friction between the floor and the load, and for the length of the pallet on which the load is mounted. The conclusions reached are negative in character, but they can be of value as a basis for further studies. The load tips so little at the sill of the floor with the ramp up that the maximum safe envelope departs only slightly from the rectangular form. It is believed that the effects of gust disturbances and of possible jamming in the rail restraint and release system should be investigated, since, from time to time, these influences will cause the load to tip through angles of inclination of a higher order of magnitude than those due to dynamical considerations. Author

N66-27608# Aviation Safety Engineering and Research, Phoenix, Ariz.

AIRCRAFT FUEL TANK DESIGN CRITERIA Final Technical Report

S. Harry Robertson and James W. Turnbow Mar. 1966 121 p refs

(Contract DA-44-177-AMC-254(T))

(USAAVLABS-TR-66-24; AvSER-65-17; AD-631610) CFSTI: HC $4.00/MF $0.75

Accident statistics indicate that postcrash fire is the most serious threat to human life in aircraft crashes. Several methods are available to reduce this hazard; however, the simplest and most effective immediate method is through control of the fuel spillage. Accident investigation reveals that fuel tanks developed to current crash-resistant fuel tank specifications fail even under relatively moderate crash conditions. A discussion of the factors which must be considered when establishing specifications that will result in a crashworthy fuel tank are presented. Experiments were conducted with fuel tank material specimens and with experimental fuel tanks subjected to actual aircraft crashes. Results indicate that fuel tanks can be built today that are capable of preventing fluid spillage during accidents involving decelerative loading above the human survival range. Evaluation of the test data indicates that additional analysis is needed in order to understand fully why certain materials function as excellent tank materials and others do not. Two types of materials, 'fuzzy wall' and 'tough wall,' are shown to have demonstrated good crash resistant chacteristics. Author (TAB)

N66-27647# Tennessee Univ., Knoxville.

A STUDY OF THE CIVIL AERONAUTICS BOARD POLICY TOWARD ROUTE STRUCTURE DEVELOPMENT OF DOMESTIC TRUNK CARRIERS

Donald G. Brisgrove (M.S. Thesis) Aug. 1965 118 p refs (Contract AF 33(608)-1118)

(AD-620406) CFSTI: HC $4.00/MF $0.75

The study investigates the Civil Aeronautics Board's policy toward developing an economically sound air-transportation system through the selection of air carriers for new routes. This was accomplished by: (1) tracing the evolution of section 401 of the Act and the Board's responsibility therefor; (2) establishing the Board's policy toward selecting a

carrier for a new route; (3) showing what effect the courts have had on Board route policy; and, (4) comparing Board policy in recent southern route development with previous route policy. Conclusions are that (1) the Board is to promote a financially strong air-transportation industry capable of meeting the needs of the Post Office, commercial interests of the country, and national defense, (2) the Board does not have the power to predetermine a route system in advance and to tell each carrier the routes it must operate over, (3) a sound air-transportation system must be in existence before the public can derive the benefits of good transportation service, (4) direct route competition has been one of the Board's major problems, and (5) the Board has realistically followed the guidance set forth in the Act. TAB

N66-27648# Tennessee Univ., Knoxville.
AN ANALYSIS OF LIABILITY IN AIRCRAFT TRESPASS AND NUISANCE CASES SINCE 1958
Raymond C. Robins (M.S. Thesis) Aug. 1965 85 p refs
(Contract AF 33(608)-1118)
(AD-620347) CFSTI: HC $3.00/MF $0.75

The study discusses the nature of the aircraft noise problem, analyzes court cases involving jet noise around airports and military bases, and identifies the factors significant in determining whether noise constitutes a compensable damage. In the 1946 'United States v. Causby' case, the U.S. was held liable for the noise of Army planes that interfered seriously with the operation of Causby's chicken farm. In the 1962 'Griggs v. Allegheny County' case, the Supreme Court held the municipality operating the Greater Pittsburgh Airport liable for aircraft noise, saying the county should have condemned enough property to prevent aircraft operations from interfering with adjacent landowners. The contention is made that (1) higher courts should insist on more consistent interpretation of the criteria used to determine when an easement has been taken, altitude alone being a less important factor than others, (2) intensity and frequency of noise and the use made of the property is more important than a line marking the property boundary, (3) rigid requirements should be set to insure adequate space for new airports, (4) solving the noise problem at existing airports should be a cooperative effort, and (5) determination of compensable noise damage should be made by courts with consideration more for degree of disturbance than for property boundaries. TAB

N66-27664# Hughes Tool Co., Culver City, Calif. Aircraft Div.
GROUND AND FLIGHT TESTS, XV-9A HOT CYCLE RESEARCH AIRCRAFT Technical Report, 10 Aug. 1964-6 Feb. 1965
C. W. Pieper Ft. Eustis, Va., Army Aviation Mater. Labs., Mar. 1966 156 p refs
(Contract DA-44-177-AMC-877(T))
(HTC-AD-65-13; USAAVLABS-TR-65-68; AD-631413) CFSTI: HC $17.20/MF $1.00

The performance, structural qualities, and feasibility of the Hot Cycle rotor and propulsion system were successfully verified for all normal helicopter flight modes. Ground tests consisted of preflight and tie-down tests, which provided a functional checkout of the aircraft systems and test instrumentation and a final checkout of the completed aircraft prior to start of flight tests. The 15 hours of flight testing included evaluation of aircraft and rotor system performance, flight loads, cooling, and flying qualities in various flight modes. Author (TAB)

N66-27729*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
JET-INDUCED LIFT LOSS OF JET VTOL CONFIGURATIONS IN HOVERING CONDITION
H. Clyde Mc Lemore Washington, NASA, Jun. 1966 35 p refs
(NASA-TN-D-3435) CFSTI: HC $2.00/MF $0.50 CSCL 01C

Jet-induced lift losses of jet VTOL configurations for hovering flight out of ground effect have been investigated by using a turbojet engine exhausting through a flat square base plate. The investigation was conducted in still air. Several base-plate sizes and nozzle configurations were investigated for a range of engine operating conditions from idle to maximum thrust. For single-exhaust-nozzle configurations the induced lift loss was about 0.5 percent of the total installed thrust and for a multiple-nozzle configuration the losses were about three times this value. It was found that the jet-induced lift losses of the large-scale turbojet-powered configuration could be adequately simulated by small-scale cold-jet models provided that the rate of decay of jet velocity downstream of the nozzle is simulated. It was also found that the lift losses could be calculated within about ±20 percent by means of an empirical expression based on the rate of decay of the jet velocity downstream of the nozzle. Author

N66-27730*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INVESTIGATION OF A SEMISPAN TILT-WING VTOL MODEL TO DETERMINE GROUND EFFECT ON FULL-SPAN FLAPS USED FOR THE YAW CONTROL IN HOVERING
Kalman J. Grunwald Washington, NASA, Jun. 1966 75 p refs
(NASA-TN-D-3437) CFSTI: HC $3.00/MF $0.75 CSCL 01C

A hovering force-test investigation on a semispan tilt-wing VTOL model was conducted to determine the ground effect on plain, single-slotted, and double-slotted full-span flaps used differentially as ailerons for yaw control. Although yawing effectiveness losses were experienced with all flap configurations near the ground, the slotted-flap configurations were considerably more effective in ground effect than the plain-flap configuration. Author

N66-27787# Naval Air Development Center, Johnsville, Pa.
ASSISTANCE IN DEVELOPMENT AND EVALUATION OF BEARING, DISTANCE AND HEADING INDICATOR (BDHI) INSTRUMENTATION Phase Report
J. L. Leavens 4 Apr. 1966 19 p
(NADC-AM-6610; AD-631152) CFSTI: HC $1.60/MF $0.50

CONCLUSIONS: BDHI instrumentation in current aircraft cannot perform to one-degree accuracy. Large errors occur during change of heading of the aircraft, and an indication lag of from four to eight degrees is common. Specifications for the equipments which are the source of signal inputs for the BDHI are wholly inadequate in defining the synchros that are to be used in the system. The BDHI specification, MIL-I-22075, does not require that the indicator be tested using the inputs that are the same as those to which it would be connected in an aircraft. Consequently indicators can pass all the requirements of the specification and still not perform satisfactorily when installed in an aircraft. If torque receiver synchros are to be used in the BDHI, then the systems which drive the BDHI must contain torque transmitter synchros. With the proper type of torque synchros installed, a satisfactory BDHI instrumentation system can be had without requiring the indicator pointers to be servo driven. Author (TAB)

N66-27896# Lockheed-California Co., Burbank.
A STUDY OF METHODS FOR EVALUATING SONIC BOOM EFFECTS
James D. Revell and Jim Rogers Thompson 1 July 1965 71 p refs
(LR-18996; AD-631003) CFSTI: HC $3.00/MF $0.75

A method for predicting and evaluating the effects of sonic booms on people and structures is needed both for the general problem and particularly for comparison of the near-field signatures of candidate SST configurations differing in area distribution. This report presents and discusses the results of two approaches to this problem. One method involves conventional transient time-history procedures and the other an investigation of the applicability of random process spectrum techniques. Both methods indicate that there is little difference between either the spectra of or system response to the near-field signatures of airplanes having conventional and three-halves power area distributions. The indicated effects of either near-field signature are less than those of the N-wave signature computed for the same airplanes and flight condition by the FAA far-field evaluation method. Author (TAB)

N66-27925*# Space Corp., Dallas, Tex.
PARACHUTE RECOVERY SYSTEM FOR A RECORDER CAPSULE Final Report No. 8, Jan. 14–Feb. 7, 1966
7 Feb. 1966 234 p
(Contract NAS8-11819)
(NASA-CR-75647) CFSTI: HC $6.00/MF $1.25 CSCL 01C

Selection of the parachute configuration, design of the dummy recorder and modified recorder capsules, and drop tests are described for a parachute recovery system for a recorder capsule. A reuseable assembly is used for the final nose cone configuration which effectively dissipates the imposed impact forces. The parachute and its deployment method are found to be reliable and effective, and the modified recorder capsule can be quickly refurbished after its recovery. M.W.R.

N66-28004# Aeronautical Research Council (Gt. Brit.).
REVIEW OF GENERAL OPERATING EXPERIENCE WITH A JET-LIFT VTOL RESEARCH AIRCRAFT (SHORT S.C.1)
D. Lean and H. W. Chinn London, HMSO, 1965 38 p refs
Supersedes RAE-TN-AERO-2913, ARC-25515
(ARC-CP-832; RAE-TN-AERO-2913; ARC-25515) CFSTI: HC $2.00/MF $0.50

In the course of the research investigation on the S.C.1 considerable experience has been obtained on the general operating characteristics of VTOL aircraft. The aircraft has been operated from normal runway surfaces as well as from a special platform, and the associated ground suction, erosion, recirculation and other effects are discussed. A detailed description of the aircraft and its equipment is included, and the serviceability and maintenance record of the aircraft is reviewed, with better results than might have been expected for an aircraft of the complexity of the S.C.1. Author

N66-28013*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
SUMMARY OF PRELIMINARY DATA DERIVED FROM THE XB-70 AIRPLANES
William H. Andrews Washington, NASA, Jun. 1966 41 p refs
(NASA-TM-X-1240) CFSTI: HC $2.00/MF $0.50 CSCL 01C

Preliminary data obtained during the initial flight-envelope expansion of the XB-70 airplanes are presented in the areas of stability and control, general performance, propulsion-system inlet operation, structural thermal response, internal noise, runway noise, and sonic boom. The general handling qualities and performance of the airplane over the flight envelope appeared to be satisfactory. Landing approach speeds were between 40 and 50 knots higher than those of current jet transports, and sink rates at touchdown were within the range of 1 to 4 feet per second experienced by the transports. Initial propulsion-system inlet operations were conservative. Structural temperature measurements compared well with predictions. Sonic-boom data indicated that near-field effects, measured on the ground, may be experienced at higher aircraft operational altitudes than anticipated. Author

N66-28034*# Schjeldahl (G.T.) Co., Northfield, Minn.
DEVELOPMENT AND TESTING OF THE DISK-GAP-BAND PARACHUTE USED FOR LOW DYNAMIC PRESSURE APPLICATIONS AT EJECTION ALTITUDES AT OR ABOVE 200,000 FEET
Clinton V. Eckstrom Washington, NASA, Jun. 1966 64 p refs
(Contract NAS1-3372)
(NASA-CR-502) CFSTI: HC $3.00/MF $0.75 CSCL 01C

The investigation of the Disk-Gap-Band parachute system consisted of a series of wind tunnel tests of models, a design study, vacuum chamber inflation tests, and a series of eleven rocket launched flight tests. The Disk-Gap-Band parachute is utilized for very low dynamic pressure applications and therefore utilizes a water vapor pressurized torus inflation aid to assist in opening the canopy at altitudes at or above 200,000 feet. The parachutes flight tested at altitudes as high as 232,000 feet opened immediately after ejection from the rockets. A problem of suspension line tangling during deployment occurred on the first few flights. This problem of line tangling was solved by modifying the parachute deployment bag to include canopy restraining straps and a shock attenuationg lanyard. Movie films from camera payloads indicate that the Disk-Gap-Band parachute is aerodynamically stable at all altitudes of operation and provides constant drag area at all times. Author

N66-28037*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLIGHT INVESTIGATION OF AN ON–OFF CONTROL FOR V/STOL AIRCRAFT UNDER VISUAL CONDITIONS
John F. Garren, Jr., Daniel J. Di Carlo, and Norman R. Driscoll Washington, NASA, Jun. 1966 26 p refs
(NASA-TN-D-3436) CFSTI: HC $1.00/MF $0.50 CSCL 01D

In an effort to determine the feasibility of utilizing an on–off pitch and roll control for VTOL operation under visual conditions for hovering and low-speed flight and to evaluate the associated control requirements, a flight investigation was conducted with a variable-stability helicopter. For several maneuvering and precision tasks, pilot evaluations were obtained for selected combinations of control power, angular-velocity damping, static stability, out-of-trim conditions, and artificial random disturbances. The results indicate that the use of an on–off control, with a properly sized dead band, reduced control power to approximately one-third of the level required for satisfactory maneuverability with the proportional control. The range of satisfactory combinations of angular-velocity damping and control power appears to be relatively small. Steady moments arising from the out-of-trim conditions and from static stability could be handled satisfactorily if such moments did not exceed 20 percent of the control power. Random disturbances which produced

peak angular accelerations of less than 50 percent of the control power could be handled satisfactorily during the performance of precision tasks. Author

N66-28048# Federal Aviation Agency, Atlantic City, N. J. Aircraft Development Service.
CHARACTERISTICS OF FIRE IN LARGE CARGO AIRCRAFT
Julius J. Gassmann Mar. 1966 55 p refs
(FAA-ADS-73)

An investigation was made to determine the requirements for protecting large cargo aircraft against in-flight cargo fires. Tests were conducted within an instrumented fuselage of a large cargo aircraft using ordinary packing material as cargo. These tests demonstrated the need for suitable detection means, air-flow shutoff controls and adequate insulation properly installed. A procedure was developed which may be useful in conducting in-flight certification tests on smoke detection system installations. A method of generating the smoke was selected on the basis of uniformity, cleanliness and freedom from odor as a result of its use during evaluation. Author

N66-28063# Federal Aviation Agency, Atlantic City, N. J. Test and Evaluation Div.
EVALUATION OF ICAO RECOMMENDED CATEGORY II APPROACH LIGHT SYSTEMS FOR HIGH PERFORMANCE AIRCRAFT Final Report
Leslie G. Rutherford Mar. 1966 58 p refs
(RD-66-23)

An evaluation of approach lighting for Category II operations was conducted at the Federal Aviation Agency's National Aviation Facilities Experimental Center, Atlantic City, New Jersey. The evaluation program was coordinated within the International Civil Aviation Organization (ICAO) to reach agreement on approach light standardization within the inner 1000 feet of the system for Category II operations. Tests were carried out in simulated and actual Category II weather conditions. Twenty-five subjects flying a DC-6B aircraft and seven subjects flying a Convair 880 aircraft participated in the weather simulation phase. Two subjects flying a DC-7 aircraft and seven subjects flying Gulfstream aircraft participated in the actual weather phase. Test results indicated that the following modifications to the inner 1000 feet would substantially improve approach success for high-performance aircraft in Category II operations: add red side rows of barrettes in line with the runway touchdown-zone barrettes, add a white cross-bar 500 feet from threshold between the rows of red barrettes, fill in the gap at threshold by continuing white-centerline and red-side-row barrettes to within 100 feet of the threshold, delete the red-wing bars 100 feet from the threshold, and delete the condenser-discharge lights. Author

N66-28072 Boeing Co., Renton, Wash.
CONTRIBUTIONS TO THE DEVELOPMENT OF A POWER-SPECTRAL GUST DESIGN PROCEDURE FOR CIVIL AIRCRAFT
J. R. Fuller, L. D. Richmond, C. D. Larkins, and S. W. Russell Jan. 1966 347 p refs Prepared for Lockheed-California Co. (Contract FA-WA-4768)
(FAA-ADS-54)

Vertical and lateral dynamic gust analyses are presented for the Boeing Model 720B aircraft, in an effort to develop a power spectral gust design procedure for civil aircraft. Two routines for assessing gust design strength based on the design envelope and the flight profile approaches were outlined. In the design envelope approach, certain flight conditions were established by successive analyses to determine the most critical flight condition for a given portion or component of the airplane, for either vertical or lateral gust loads. The flight profile approach was used to determine the expected number of hours that the airplane could be operated before the limit design strength of any of its major components would be exceeded. The 720B was studied by both approaches: first, the bending moments on the wing, fuselage, and vertical tail were used as indices of their strengths; second, a joint probability stress analysis was used to define the more critical structural areas. D.T.

N66-28164# Deutsche Forschungsanstalt für Luft- und Raumfahrt, Brunswick (West Germany). Institut für Flugmechanik.
DIGITAL METHODS FOR THE DETERMINATION OF THE STABILITY OF A CONTROLLED AIRCRAFT. PART I: THEORY [DIGITALE VERFAHREN ZUR BERECHNUNG DER STABILITAETSEIGENSCHAFTEN VON GEREGELTEN FLUGZEUGEN. TEIL I: THEORETISCHE GRUNDLAGEN]
G. Rosenau 1 Dec. 1965 88 p refs In GERMAN; ENGLISH summary Sponsored in part by the Deut. Forschungsgemeinschaft
(DLR-TB-65-66) CFSTI: HC $3.00/MF $0.75

Methods were developed to investigate the variation of the local stability of the motion of an aircraft with the variation of parameters of the aircraft or the control system. The controlled aircraft was treated as a multivariable system. For the different methods, programs for digital computers were realized. The transfer functions corresponding to the linearized system of differential equations of the controlled aircraft were set up, and the stability of the system was determined from the roots of the resulting characteristic equation or from root loci in the case of further modification of one parameter of the control system. Author

N66-28306*# Naval Air Engineering Center, Philadelphia, Pa.
STATISTICAL PRESENTATION OF LANDING PARAMETERS FOR MODEL A-1H AIRCRAFT ABOARD THE USS ORISKANY (CVA-34) IN THE WESTPAC AREA Summary Supplementary Report, 24 Jan.-19 Feb. 1964
Warren J. Williams 1 Mar. 1966 64 p ref
(NAEC-ASL-1093; AD-629931) CFSTI: HC $6.00/MF $0.75
CSCL 01B

A statistical analysis of aircraft approach and landing contact data for normal fleet operations in WESTPAC for the model A-1H aircraft during January and February 1964. The parameters are presented in the form of histograms and probability curves. Statistical values for each parameter are listed in the summary table. Author (TAB)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N66-28857# Joint Publications Research Service, Washington, D. C.
EXPERIMENTAL SOLAR ELECTRIC POWER PLANT

N. S. Lidorenko, F. Kh. Nabiullin, A. P. Landsman, B. V. Tarnizhevskiy, Ye. M. Gertsik et al *In its* Heliotechnology, no. 3, 1965 26 Apr. 1966 p 1-5 refs (See N66-26887 15-33) CFSTI: $3.00

An experimental solar electric power plant, capable of producing from several hundred watts to one kilowatt, was designed, fabricated, and tested. The individual photocells were laid out in strip form on a 1×5 m frame. Collecting mirrors were placed between each strip in order to increase the light flux density to the battery surface. Three such panels were constructed giving a total battery surface of 3.6 m^2. The panels were connected by a common shaft which was turned by an electric motor to keep the panels facing the sun at all times. Optimum output of the device, which was used to power a water lift mechanism for irrigation purposes, was 248 watts at 45 V; the efficiency of the battery itself was 3.5%, and that of the whole unit, 2.6%. D.T.

N66-26888# Joint Publications Research Service, Washington, D. C.

TESTING SILICON PHOTOBATTERIES IN LARGE LIGHT FLUXES

A. Ya. Bashnyak and L. V. Nechayeva *In its* Heliotechnology, No. 3, 1965 26 Apr. 1966 p 6-9 refs (See N66-26887 15-33) CFSTI: $3.00

Service life tests were conducted on silicon photobatteries under large luminous fluxes, i.e., from 8000 to 12,000 w/m^2, and under direct solar radiation. Volt-ampere characteristic curves were taken both for the photobattery as a whole and for each of its sections. During prolonged testing many of the photocells became uncemented from the cooling element, and consequently underwent cooling only by radiation and convection, which is inadquate in large light fluxes. The power output dropped from 150 to 125 watts, and the efficiency of the whole unit from 6.7 to 3.7%. Since the efficiency of any solar battery is an inverse function of temperature, it is pointed out that particular attention must be given to the connections and heat removal. D.T.

N66-27067*# TRW Equipment Labs., Cleveland, Ohio.

TRW SPACE RADIATOR-CONDENSER DESIGN AND PERFORMANCE ANALYSIS COMPUTER PROGRAMS Users' Manual

Apr. 1966 340 p refs

(Contract NAS9-4884)

(NASA-CR-65362; ER-6792) CFSTI: HC $7.00/MF $1.75 CSCL 10B

This report presents the analyses required to design and analyze a direct space condenser-radiator of general geometry utilizing any working fluid including a combination of a condensable vapor and noncondensable gas. These analyses are then reduced to a computer-usable form and a series of five computer programs (in Fortran IV) capable of designing and analyzing these radiators are described. Lastly, the instructions for the operation of these computer programs are delineated. These computer programs consider such items as: flat plate, triform, cruciform, cylindrical, and conical panel configurations; operation in a variable gravitational field (including zero g); automatic bypass and segmentation to control outlet temperature; fixed inventory or pressure regulated condensers; non-uniform sink temperature; and single and parallel tube flow stability. Author

N66-27080*# National Aeronautics and Space Administration, Washington, D. C.

FIRST ELECTRIC POWER SYSTEM IN AEROSPACE

Ernst M. Cohn [1963] 7 p Submitted for Publication

(NASA-TM-X-56704) CFSTI: HC $1.00/MF $0.50 CSCL 10B

This paper describes the type of battery powered electric lamps used by French balloonists during the Franco-Prussian War of 1870. One was the portable electric safety lamp used by miners, and the other consisted of a multiple reserve battery connected to a fluorescent light through a spark coil. R.N.A.

N66-27187*# Stanford Univ., Calif.

PLASMA THERMIONIC DIODES

Dec. 1964 18 p

(Grant NsG-299-63)

(NASA-CR-60145) CFSTI: HC $1.00/MF $0.50 CSCL 10A

Results for a low-pressure (collisionless) one-dimensional thermionic converter are summarized in a study of the randomization of electron energies in thermionic diodes by computer methods. It was found that when the separation between the emitter and collector plates is larger than ten electron Debeye lengths, the operation of the diode is determined essentially by two parameters: (1) the ratio of charge densities near the emitter and (2) the applied potential. Plots of potential are included for four regions in which the fluctuations are expected to be the greatest. C.T.C.

N66-27211*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

NICKEL CADMIUM SPACECRAFT BATTERY CHARGE CONTROL WITH AUXILIARY ELECTRODES

Kenneth O. Sizemore and Eugene R. Stroup [1965] 5 p ref Presented at the Meeting of the Electrochem. Soc., Buffalo, 10-14 Oct. 1965 Submitted for Publication

(NASA-TM-X-56519) CFSTI: HC $1.00/MF $0.50 CSCL 10A

Nickel cadmium spacecraft batteries are being fitted with auxiliary or control electrodes that indicate the fully charged state of the battery. The studies include performance characteristics, methods of instrumentation and utilization, life expectancy, and relationship of performance to temperature, depth of discharge and internal cell pressure. It is considered that continuing research and development is necessary before the full potential of this device will be realized. Author

N66-27242*# Naval Ammunition Depot, Crane, Ind.

[NASA SPACE CELL TEST PROGRAM] Monthly Progress Report, Apr. 1966

27 May 1966 172 p

(NASA Order W-11252B)

(NASA-CR-75379) CFSTI: HC $5.00/MF $1.00 CSCL 10A

Progress is reported on a space cell test program. Results are tabulated for life cycle tests on nickel cadmium, silver cadmium, and silver zinc 5 and 10 cell packs. Also included are a list of test parameters, a detailed failure analysis, tabulated capacity test results, and data sheets giving end of discharge and end of charge voltage readings for each cell on each cycle recorded. R.N.A.

N66-27243*# Electro-Optical Systems, Inc., Pasadena, Calif.

DEVELOPMENT OF LIGHTWEIGHT RIGID SOLAR PANEL Interim Design Report, 1 Jan.-30 Apr. 1966

18 May 1966 371 p refs

(Contract NAS7-428)

(NASA-CR-75370; EOS-7027-IDR) CFSTI: HC $7.00/MF $2.00 CSCL 10A

The final solar array studied in this program will use an aluminum alloyed electroformed substrate and a beryllium frame. Solar array design is based on the use of a 4-mil silicon solar cell with an air mass zero efficiency of 9.6 percent at 28°C. A 10.4 kW array was designed which will fit within an Atlas/Centaur shroud and provide power on a Jupiter flyby mission. Array equilibrium temperature ranges from +145°C at 0.6 AU to −128° C at 5.2 AU. Voltage output at earth is 100V nominal. The specific weight of the array, using aluminum alloy electroforming and beryllium frames, is 27.4 lb/kW based on power output at earth and including all mechanisms. The 10.4 kW array is self-deploying, using a series of spacecraft commands to release pyrotechnic devices. The same array, using a nickel substrate and aluminum frame, would weight 42.4 lb/kW using 3-mil cover glass on the solar cells. The basic objective of the program is to fabricate and use large photovoltaic solar arrays with specific weight capability of 25 to 50 lb/kW. The primary design emphasis being placed on structures and mechanisms. Feasibility of the 25 to 50 lb/kW array will be demonstrated by design analysis and a demonstration solar panel, approximately 25 sq ft, which will be subjected to Atlas/Centaur launch environmental tests. The demonstration panel will use an electroformed nickel substrate supported by an aluminum frame. The substrate structure has a double curvature and uses a hollow core or honeycomb configuration. Silicon solar cells with thicknesses of 4 and 8 mils shall be used to demonstrate compatibility with the structure. Author

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N66-27314*# Bendix Corp., Southfield, Mich. Research Labs. Div.

FABRICATION AND TEST OF A FLUERIC POSITION SERVO Quarterly Report, 10 Sep.–10 Dec. 1965

[1965] 58 p ref

(Contract NAS3-6201)

(NASA-CR-54900; BRLD-3255) CFSTI: HC $3.00/MF $0.50 CSCL 13G

This report is the second quarterly report of Task 2 of an effort to develop a pneumatic control drum actuator for a nuclear rocket engine in which the electronics have been replaced by flueric devices. The objective of the Task 2 effort is to fabricate and test the system designed and studied in Task 1. In this quarter, the designs of the Position Error Detector Unit and Power Control Valve were completed. Breadboard vortex valves, single input amplifiers and summers were built and tested. The lead-lag circuit was revised and preliminary tests on an early design of the circuit were conducted. Author

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N66-27316*# Livingston Electronic Corp., Montgomeryville, Pa.

LOW TEMPERATURE BATTERY First Quarterly Report, 14 Dec. 1965–13 Mar. 1966

George M. Armstrong [1966] 43 p

(Contract NAS3-8503)

(NASA-CR-54970) CFSTI: HC $2.00/MF $0.50 CSCL 10A

The system, Mg/KSCN:NH_3/$HgSO_4$:S:C, has been studied in order to develop a primary cell with the capability of 72 hours operation at −90°C. Five methods of approach were developed from the original considerations. Method 1, the development of pasted-plate cathode construction, is the objective of the work covered by this report. A maximum cell life of 117 hours was obtained at −90°C with a cathode comprising $HgSO_4$:S:C in the ratio by weight of 5:1:3. Seven other $HgSO_4$/S cells ran for 71 or more hours. Four S:C cells ran for periods ranging from 71 to 113 hours. The best one contained 87% sulfur and 15% carbon. Author

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N66-27323*# Melpar, Inc., Falls Church, Va.

ANALYSIS, DESIGN AND DEVELOPMENT OF A FLAT PLATE SOLAR THERMOELECTRIC ENERGY CONVERSION PANEL Final Report, 12 Jun.–12 Dec. 1965

[1965] 167 p refs

(Contract NAS5-3400)

(NASA-CR-76388) CFSTI: HC $5.00/MF $1.00 CSCL 10A

This report covers the technical effort on the first phase of a program directed toward the analysis, design, and fabrication of a flat plate solar thermoelectric power generation module. This panel should be capable of producing three to six watts of electrical power per square foot of oriented collector surface, with a weight factor of at least fifteen watts per pound (including support structure) in an earth orbit. The technical effort covered: a design analysis, mechanical and configurational design of flat plate thermoelectric panels meeting the performance and weight requirements, separate testing and selection of thermoelectric materials, analysis of behavior of these materials, and the couples made from them, fabrication and evaluation of experimental thermoelectric unit couples, and fabrication and initial testing of flat plate thermoelectric panels. The design analysis was based upon the performance of experimental thermoelectric couples and demonstrated the practicability of achieving the thermoelectric performance required in a flat plate generator panel. Existing available Bi_2Te_3 based alloy materials have been shown to have poorer characteristics than can be deduced from current literature, and extensive work on material evaluation and selection was necessitated. Author

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N66-27324*# Space-General Corp., El Monte, Calif.

FINE ATTITUDE CONTROL SYSTEM, VOLUME I Final Report

Jul. 1965 158 p refs

(Contract NAS5-9056)

(NASA-CR-75392; SGC-742R-8) CFSTI: HC $5.00/MF $1.00 CSCL 17G

Phase I of a program for the development of a Fine Attitude Control System (FACS) was completed. The FACS, using a combination of gyro-inertial and optical sensors, is designed to point the experiment package of an Aerobee 150 series rocket at the sun or at a series of stellar targets. This phase involved the design, fabrication, and testing of a breadboard model of the FACS and of associated ground support equipment. The breadboard FACS was constructed by integration of individual breadboard subassemblies into a structure suitable for mounting on a flight simulator. Subassemblies were individually tested prior to integration. The system's acceptability was successfully demonstrated at a 3-axis gas bearing simulator facility. R.N.A.

N66-27325*# Space-General Corp., El Monte, Calif.

FINE ATTITUDE CONTROL SYSTEM, VOLUME II Final Report

Jul. 1965 286 p

(Contract NAS5-9056)

(NASA-CR-75393; SGC-742R-8) CFSTI: HC $6.00/MF $1.50 CSCL 17G

This report contains the appendices to Phase I of a program for developing a Fine Attitude Control System (FACS) which uses a combination of gyro-inertial and optical sensors to point the experiment package of an Aerobee 150 series rocket at the sun or at stellar targets. The appendices include functional descriptions and schematics, a breadboard FACS parts list, a pneumatic analysis of the Aerobee attitude

control system force control system, breadboard FACS subassembly and module test data, FACS system test and calibration data, the breadboard FACS telemetry signal conditioner calibration, operational procedures and parameter changes, FACS technical note re-evaluation of ramp maneuver characteristics, an explanation of the deferment of roll slaving until completion of attitude capture, and a correction of the effect of inner gimbal angle on torquing rate. R.N.A.

N66-27489*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SAHA-LANGMUIR SURFACE IONIZATION RELATION
Roland Breitwieser and Wayne Rush Washington, NASA, 1965 17 p refs Presented at the Thermionic Specialist Conf. Sponsored by IEEE, San Diego, Calif., 25-27 Oct. 1965 (NASA-TM-X-52152) CFSTI: HC $1.00/MF $0.50 CSCL 10A

The experimentally observed ion production rate in a cesium thermionic converter with tungsten electrodes is 3 to 4 times the rate predicted by the Saha-Langmuir equation. The ion emission rate is found to be dependent on field and corresponds to an exp (e $\sqrt{eE}$/kT) (Schottky) relation. The Schottky effect is unambiguous only at very small spacings (3 to 11μ) and at conditions of low ionization probabilities. Agreement between ion current and simple space-charge theory is observed. This agreement and the departure from the Saha-Langmuir relation suggest that the ions are formed at localities of higher work function than the electrons. The difference in work function for ion and electron production thus reduces the effectiveness of ions in reducing the space charge of electrons at the electron-saturation condition. Observations on the coupling of ion motion to particle arrival rate are also made. Author

N66-27496*# National Aeronautics and Space Administration. Washington, D. C.
ENERGY ACCUMULATOR IN OPTIMIZATION PROBLEMS OF SPACEFLIGHT WITH LIMITED POWER [NAKOPITEL' ENERGII V ZADACHAKH OPTIMIZATSII KOSMICHESKOGO POLETA S OGRANICHENNOY MOSHCHNOST'YU]
G. L. Grodzovskiy, B. N. Kiforenko, and V. V. Tokarev May 1966 32 p refs Transl. into ENGLISH from Russian (NASA-TT-F-10132) CFSTI: HC $2.00/MF $0.50 CSCL 10C

The problem under consideration deals with the optimization of a low-thrust spaceflight with an energy-storing device. A general variational problem is formulated, and analysis of optimal control is made. Some solutions for the movement in a forceless field and the turn of a satellite orbit are cited. Author

N66-27530*# Atomics International, Canoga Park, Calif.
RADIATION EFFECTS ON SILVER AND ZINC BATTERY ELECTRODES, IV Interim Report, Jan.-Apr. 1966
M. M. Nicholson, H. L. Recht, R. E. Kelchner, and W. A. Mc Collum 27 May 1966 37 p refs Prepared for JPL (Contracts NAS7-100; JPL-951109)
(NASA-CR-75394; AI-66-83) CFSTI: HC $2.00/MF $0.50 CSCL 10C

Gamma radiation effects on silver oxide battery electrodes at 90 and 60% states of charge were studied in experiments designed to detect changes in discharge capacity, gas evolution, and solid material loss. A voltage follower circuit was incorporated into the automatic capacity measuring equipment to record and control the test electrode potential against a reference electrode. A capacity increase of 14% was noted in cells receiving a dose of 7×10^7 rads of Co^{60} radiation while cycling at 90=95% charge. Control cell capacity increased 15%. Capacity changes due to radiation are small compared to the combined effects of cycling, temperature, and time. Solid material loss from silver electrodes was higher in the irradiated cells than in the controls. At the 90% charge level there was a 3% net loss in silver content, and a 1.5% loss at the 60% charge. The gas evolution data were improved by an exchange procedure that established a nitrogen atmosphere in the cells immediately before irradiation. The gradual formation of hydrogen was again noted in irradiated cells, with the final gas phase containing as much as 19%. After cycling, both irradiated and control cells contained large amounts of oxygen. R.N.A.

N66-27544*# Melpar, Inc., Falls Church, Va.
ANALYSIS, DESIGN AND DEVELOPMENT OF A FLAT PLATE SOLAR THERMOELECTRIC ENERGY CONVERSION PANEL Final Report, 17 Apr.-17 Oct. 1964
[1964] 116 p refs
(Contract NAS5-3782)
(NASA-CR-75381) CFSTI: HC $4.00/MF $0.75 CSCL 10A

This report covers the technical effort during the second phase of a program directed toward the development and fabrication of a flat plate solar thermoelectric power generation panel. This panel should be capable of producing from 3 to 6 watts of electrical power per square foot while providing a weight factor of 15 watts per pound. These goals were achieved in flat plate unit couple form. The technical effort included: a comprehensive analysis of the solar flat plate generator, an extensive redesign of the unit couple and the panel structure, an experimental program aimed at improving the bonds to Bi_2Te_3 alloy thermoelectric generator material, the fabrication of quantities of flat plate unit couples and their assembly into flat plate panels, and life testing of flat plate unit couples, both under steady-state and thermal cycling conditions. Author

N66-27633# Texas Instruments, Inc., Dallas.
EXTENDED MOLTEN-CARBONATE FUEL CELL SYSTEM PROGRAM Final Report, 15 Feb.-30 Nov. 1965
James K. Truitt Jan. 1966 30 p
(Contract DA-44-009-AMC-54(T))
(TI-08-66-02; AD-631500) CFSTI: HC $2.00/MF $0.50

The purpose of this program extension was to test the scale-up characteristics a low-cost module concept and to increase power density to a level of 60 watts per square foot of cell area. Seven 36-cell modules, each having one square foot of cell area, but with some variations in cell structure, were constructed and tested. Two module configurations were used: one had six rows of six cells each in electrical series, and the other had 18 pairs of cells in series. Tests of the six-cell modules generally produced 35 to 45 watts per square foot during the first few hundred hours of operation, but occasionally the output exceeded 60 watts per square foot. Such deviations were also observed in the cells of the larger modules described in this report. Some fabrication and operational problems associated with these larger modules were effectively overcome. Modifications were made in the plenums to improve the distribution of fuel. The maximum output obtained using hydrogen in these modules was 60.6 watts. Under otherwise like conditions but using a synthetic partial oxidation fuel, 48.6 watts output was attained. Author (TAB)

N66-27645# Union Carbide Corp., Parma, Ohio. Research Lab.
THIN FUEL CELL ELECTRODES Quarterly Progress Report No. 3, 1 Nov. 1965–31 Jan. 1966
M. B. Clark and K. V. Kordesch Apr. 1966 50 p *its* Rept.-7
(Contract DA-28-043-AMC-01344(E))
(ECOM-01344-3; AD-631368) CFSTI: HC $4.60/MF $0.50

Thin electrodes of established structure and catalytic activity were produced in such quantity as to allow the building of fourteen 6-volt, 100-watt hydrogen-air batteries. The first six batteries were used to determine general performance parameters which served as guidelines for the life-testing program for the remaining eight batteries. The interrelationship between temperature, relative humidity and electrolyte concentration was studied. Current density polarization curves of the batteries were determined several times during the operational life of the batteries with air, and with oxygen. Tests to compare different modes of operation (intermittent versus continuous) and different electrolytes (NaOH and KOH) were started. The life-testing program includes performance checks at different temperature levels, and also a comparison between CO_2-free and CO_2-containing air. Author (TAB)

N66-27736*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
POSSIBLE SOURCES OF INSTABILITY IN THE COLLISIONLESS THERMIONIC DIODE
Charles M. Goldstein Washington, NASA, Jun. 1966 7 p refs
(NASA-TM-X-1245) CFSTI: HC $1.00/MF $0.50 CSCL 10A

It is shown that cusps occur in the density distributions derived from the collisionless thermionic diode analysis. The possible effect of these cusps on diode stability and the collisionless current-voltage characteristics are discussed. Author

N66-27741*# Radio Corp. of America, Princeton, N. J. RCA Labs.
MATERIALS AND METHODS FOR LARGE-AREA SOLAR CELLS Final Report, 17 Dec. 1964–16 Dec. 1965
S. G. Ellis, R. R. Rodiss, Jr., P. Vohl, and P. Rappaport Washington, NASA, 14 Jan. 1966 34 p refs
(Contract NAS3-6466)
(NASA-CR-54959) CFSTI: HC $2.00/MF $0.50 CSCL 10A

GaAs/InAs/Al foil structures have been grown by oxide transport from the respective compounds. Preliminary studies have ben made of the growth from the metallic elements using both halide transport and oxide transport. These latter methods have not yet been perfected. The light transmission of some cuprous selenide films on glass has dropped after a period of several months. It is believed that this is due to a cubic → tetragonal phase change. The fact that this change does not occur in all films shows that stable films can be made. Gold gridded $Cu_{1.8}Se$/GaAs/InAs/5μ Al foil solar cells have been made with an efficiency of 4.3% (for an area of 0.73 cm^2) and a power-to-weight ratio of 135 W/lb. With an etching treatment, such cells (on aluminum foil, with efficiencies in the 3% to 4.5% range) have shown no degradation for periods up to 4 months of shelf life, and one month under load at room ambient. Author

N66-27751*# Radio Corp. of America, Princeton, N. J. Astro-Electronics Div.
NIMBUS-B SOLAR-CONVERSION POWER SUPPLY SUBSYSTEM Quarterly Technical Report No. 1, Sep.–Nov. 1965
24 Jan. 1966 60 p
(Contract NAS5-9668)
(NASA-CR-75468; AED-R-2889) CFSTI: HC $3.00/MF $0.50 CSCL 10A

Based on theoretical and experimental data, the Nimbus-B solar cell array was analyzed to obtain a mean I-V curve of a solar cell in a 10-cell module; to estimate flux degradation factors due to radiation, and to determine worst-case design factors. A computer program was also used to obtain an I-V curve of a solar cell in an array at various points in the mission and at the desired temperatures. The results are presented in tabular form and are graphically depicted. In the technical study of the battery module, acceptance and cycling test data, received from two contractors on Nimbus-type cells, were analyzed. The findings are plotted, and it was concluded that the results of one year of cycling cannot be predicted. To provide data for computer inputs, estimates were made of cell discharge and charge voltages at 25°C for various discharge and charge currents as a function of time; heat generation curves, based on an energy balance, were also obtained. Development work on the battery control and protection circuits is described, and the electrical and mechanical designs for the electronics module are discussed. M.G.J.

N66-27752*# Radio Corp. of America, Princeton, N. J. Astro-Electronics Div.
NIMBUS-B SOLAR-CONVERSION POWER SUPPLY SUBSYSTEM Quarterly Technical Report No. 2, Dec. 1965–Feb. 1966
31 Mar. 1966 166 p refs
(Contract NAS5-9668)
(NASA-CR-75465; AED-R-2925) CFSTI: HC $5.00/MF $1.00 CSCL 10A

This report describes efforts during this period on the development of the Nimbus-B solar conversion power supply subsystem for the Nimbus meteorological satellite. The systems engineering effort was concerned with evaluating the power subsystem performance. Shunt dissipator threshold voltage range and power dissipation requirements were determined. The possibility of undesirable operating points in the power subsystem was studied. The effects of black box failure modes on power subsystem operation were analyzed. Battery module studies consisted of an analysis of Crane cycling data, a revision of preliminary parametric study curves, the preparation of preliminary curves indicating cell voltages during the launch phase, and a battery test to determine the feasibility of applying battery power to blow the regulated bus fuses. The operation of the battery electronics is discussed on a circuit level. The major change made in the battery module electronics was the elimination of the shunt loss reducer circuit. Breadboard fabrication and testing of the electronics module circuitry was completed. Design modifications to the auxiliary and shunt dissipator are summarized and the electronics module power dissipation for three conditions of overall spacecraft system operation is discussed. R.N.A.

N66-27788# Minnesota Mining and Mfg. Co., St. Paul, Minn.
300 WATT PORTABLE THERMOELECTRIC GENERATOR Monthly Progress Report, Period Ending 31 Mar. 1966
Thomas L. Nystrom 12 Apr. 1966 5 p
(Contract N600(61533)62758)
(MPR-13; AD-631037) CFSTI: HC $1.10/MF $0.50

The system design was modified to reduce the dry weight to 25 pounds and to improve the reliability of the

hermetic seal. The generator system was started and operated outdoors when the wind was 17 mph gusting to 25 mph. Noise level tests were conducted on the system in an anechoic chamber. The maximum broad band sound pressure level is 52 dB at a distance of 50 feet. Author (TAB)

N66-27947*# Douglas Aircraft Co., Inc., Newport Beach, Calif. Astropower Lab.

SMALL FUEL CELL TO ELIMINATE PRESSURE CAUSED BY GASSING IN HIGH ENERGY DENSITY BATTERIES Progress Report, 30 Sep.–30 Dec. 1965

H. Frank and M. P. Strier Jan. 1966 35 p refs (Contract NAS5-9594)

(NASA-CR-75596; SM-48457-Q2) CFSTI: HC $2.00/MF $0.50 CSCL 10A

Life tests were conducted on a miniature fuel cell in specially designed battery simulators for the purpose of providing necessary design data for specifying the appropriate size and configuration of miniature cells capable of handling the gassing rates (with resulting high pressure buildup) encountered in any size silver–zinc battery under anticipated operating conditions. Life tests using the open end flow method of operation without the use of wicks to transfer the product water from the fuel cell to the battery electrolytes; tests using dead end flow both with and without wicks; tests carried out with mixtures of H_2 and O_2 in both the anode and cathode under open end flow conditions; and tests designed to measure gas consumption rates are described. Thus far the fuel cell has been demonstrated to function for at least 3800 hrs. Results of the various tests are discussed. L.S.

N66-27956*# Electro-Optical Systems, Inc., Pasadena, Calif. Power Systems Div.

HYDROGEN–OXYGEN ELECTROLYTIC REGENERATIVE FUEL CELLS Progress Report, 1 Feb.–1 Mar. 1966

Martin G. Klein and Eugene Findl 10 Mar. 1966 24 p (Contract NAS3-2781)

(NASA-CR-75515; EOS-4110-ML-24) CFSTI: HC $1.00/MF $0.50 CSCL 10A

Cyclic tests were conducted on nineteen different regenerative hydrogen oxygen (RHO) single fuel cells in order to evaluate the performance of the various electrode structures used in the cells. Test results and construction variables of the electrodes are discussed, and summarized in a table. The results should lead to cell designs having improved life cycle capabilities, and a better understanding of the modes of deterioration in performance during cycling. Comments on the performance of each tested cell are given. In addition, a multicell (six cell, nominal 75-watt) unit was also assembled and subjected to test, using gold-coated platinized electrodes that indicated improved life in single cell tests. Thus far, results indicate that there is a gradual degradation in voltage performance, but additional cycling must be done for conclusive results. An analytical test of a gold-coated carbonyl nickel plaque was conducted to determine the quantity of gold actually deposited in the plaque, as a check on the processing to assure that the gold coverage intended was actually obtained. L.S.

N66-28038*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF TURBINE-COOLANT FLOW ON BRAYTON-CYCLE SPACE-POWER SYSTEM THERMODYNAMIC PERFORMANCE

Arthur J. Glassman Washington, NASA, Jun. 1966 17 p refs (NASA-TN-D-3474) CFSTI: HC $1.00/MF $0.50 CSCL 10B

The effects of turbine-coolant flow on the thermodynamic performance of Brayton-cycle space-power systems were studied. A reference system was established, and the interrelated effects of turbine-inlet temperature, coolant-flow rate, and turbine efficiency on radiator area were examined for turbine-inlet temperatures to 3500°R. Coolant-flow requirements as a function of temperature and turbine-efficiency change as a function of coolant flow were varied parametrically, with the maximum uncooled turbine-inlet temperature assumed to be 2500°R. The most significant thermodynamic effect resulting from the use of turbine-coolant flow at any given turbine-inlet temperature was an increase in radiator area. The potential reduction in radiator area obtainable with increasing turbine-inlet temperature, therefore, depends strongly on the associated coolant-flow requirement as well as on the turbine-efficiency variation. Increasing turbine-inlet temperature through the use of turbine cooling can result in a radiator-area reduction, but this potential reduction can be nullified by a high-coolant-flow requirement or a severe degradation in turbine efficiency. Author

N66-28118# Library of Congress, Washington, D. C. Aerospace Technology Div.

ELECTROSTATIC AND ELECTROMAGNETIC GENERATORS—ANNOTATED BIBLIOGRAPHY Surveys of Soviet Scientific and Technical Literature

Jordan V. Randjelovic 14 Jan. 1966 30 p refs (ATD-66-10)

This annotated bibliography was compiled from Soviet open sources published 1961–1964. It reviews Soviet developments in electrostatic and electromagnetic generators as reflected in transactions of the various Soviet institutes active in this field. Information not directly related to the assigned subject has been included because of its broad implications for study in this field. The 72 entries are arranged by institute. Arrangement within the institutes is alphabetical by author. Other information included: claw-shaped pole, contactless synchronous machines, magnetic flux component, inductor machine, synchronous coupling induction system, integrated selsyn motor, contactless d-c generator, semiconductor commutator, multipolar contactless selsyns, polyphase inductor machine, flat and arc-shaped stators, torque motor, double-tooth windings, toothed rotor, contactless d-c tachogenerators, squirrel-cage rotor, controlled induction capacitor motor, low-speed synchronous micromotors, harmonic rotor, asynchronous frequency converter, electric machine windings, magnetoelectric generator, parametric motor, reversible induction dynamoelectric amplifier, hysteresis motor, winding wire. Author

N66-28187# Royal Aircraft Establishment, Farnborough (England).

OPINION STUDY ON THE SONIC BANG [ETUDE D'OPINION SUR LE BANG SUPERSONIQUE]

Apr. 1966 49 p Transl. into ENGLISH of Centre d'Etudes et d'Instruction Psychologiques de l'Armée de l'Air, Study no. 22, 1966

(RAE-LIB-TRANS-1159) CFSTI: HC $2.00/MF $0.50

The report presents the results of a public opinion study of the reactions to the sonic bang by the populations in the East and South-West of France where there has been appreciable supersonic flying over the past few years. The survey investigates the population sensitivity to the sonic bang as affected by geographical, sociological and attitudinal variables. Author

N66-28252# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONTROL DEVICE FOR ELECTROLUMINESCENCE CELLS
P. A. Savis'ko, I. Z. Prusakov, and Yu. I. Chernyshev 23 Mar. 1966 5 p Transl. into ENGLISH from Russian patent no. 168527 (Appl. no. 891389/26-24, 28 Mar. 1964) 2 p
(FTD-TT-65-1169/1+2+4; AD-631576) CFSTI: HC $1.10/MF $0.50

The object of the invention is a control device for an electroluminescence cell which contains an electroluminescence element joined with the secondary winding of a transformer, the primary winding of which is connected up to the output of the control device; and which has the distinguishing feature that, for the purpose of improving the dependability of the preservation of the information and the selection of the element, it is designed with a tristable inductive 'parametron' into the input circuit of which there is connected in series a coupling transformer with three control windings.
Author (TAB)

N66-28254# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HIGH-VELOCITY AIR TURBINE ENGINE
S. N. Sidorov and I. Ya. Vishnyakov 23 Mar. 1966 7 p Transl. into ENGLISH from Russian patent no. 164885 (Appl. no. 827283/26-10, 26 Mar. 1963) 3 p
(FTD-TT-65-1737/1+2+4; AD-631445) CFSTI: HC $1.10/MF $0.50

The object of the invention is a high-speed air turbine to be used in moving picture technology in the recording and study of rapid processes accompanied by light phenomena measured in intervals of time of the order of 10^{-8} sec. For the purpose of increasing the speed of the turning of a mirror rotor and raising the power of the turbine, the curvilinear channels of the nozzle device directing the flow of air in a radial direction onto the operating wheel of the turbine are designed as a rectangular section with a narrowing area in the middle part and are disposed in fan fashion.
Author (TAB)

N66-28334# Royal Aircraft Establishment, Farnborough (England).
REVIEW OF EARTH SATELLITE COMBINED ATTITUDE AND ORBIT CONTROL SYSTEMS
A. G. Earl and B. P. Day Mar. 1966 37 p refs
(RAE-TR-66082) CFSTI: HC $2.00/MF $0.50

This report considers the likely specification for a combined attitude and orbit control system for various satellite applications. The performance of several types of control system are then estimated and compared; it is concluded that an electrolyzed water system is likely to be the lightest, with a hydrazine–catalyst system very close to it. Because of the severe operational limitations of electrolyzed water systems, however, it is recommended that a hydrazine system should be developed for any initial station keeping satellites, but that research should continue on electrolyzed water and plasma systems for longer term projects.
Author

N66-28383*# Clevite Corp., Cleveland, Ohio. Electronic Research Div.
STUDY OF THIN FILM LARGE AREA PHOTOVOLTAIC SOLAR ENERGY CONVERTER Second Quarterly Report, 26 Feb.–24 May 1966
F. A. Shirland, J. R. Hietanen, F. Augustine, and W. K. Bower 23 May 1966 22 p refs
(Contract NAS3-8502)
(NASA-CR-54985) CFSTI: HC $1.00/MF $0.50 CSCL 10A

The design changes made in the development of a CdS thin film solar cell are discussed. These changes include the substitution of a gold pigmented epoxy cement for grid attachment in place of conductive silver epoxy cement, and the substitution of clear epoxy cement to laminate the cover plastic to the cell in place of the nylon plastic used previously. It is reported that with these modifications, the solar cell will prove to be stable on extended shelf storage, in moderately humid ambients, and on temperature cycling. The additional progress made in cell fabrication, cell design, and stability studies are reviewed.
H.S.W.

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N66-26917# Joint Publications Research Service, Washington, D. C.
MODERN TECHNICAL ADVANCES IN MEDICINE
Ye. B. Babskiy and V. V. Parin, ed. 19 May 1966 181 p refs Transl. into ENGLISH of "Dostizheniya Sovremennoy Tekhniki v Meditsine" Moscow, Medicine Publishing House, 1965 p 1–172
(JPRS-35611; TT-66-32046) CFSTI: $4.00

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7. ARTIFICIAL ARMS WITH BIOELECTRIC CONTROL Ya. S. Yakobson, Ye. P. Polyan, and V. M. Bernshteyn p 122–145 refs (See N66-26924 15-04)

N66-26918# Joint Publications Research Service, Washington, D. C.
RADIOTELEMETRIC EQUIPMENT FOR STUDYING PHYSIOLOGICAL PROCESSES IN A FREELY MOVING PERSON
V. V. Rozenblat *In its* Mod. Tech. Advan. in Med. 19 May 1966 p 3–36 refs (See N66-26917 15-04) CFSTI: $4.00

Three basic types of telemetric systems used to obtain biomedical information are classified according to the positioning of the transmitter and the research organism; that is, the transmitter may be located some distance from the organism under study, on the organism, or within the body

cavity of the subject. The latter two are referred to endoradiosonde and dynamic biotelemetry, respectively; and these in conjunction with so-called onboard telemetry have been combined to obtain data either on space or of interest to space research. State-of-the-art in biotelemetry is reviewed, and various devices are described for studying physiological processes in a freely moving person. M.W.R.

N66-26919# Joint Publications Research Service, Washington, D. C.

RADIOTELEMETRIC RESEARCH ON THE FUNCTIONS OF THE DIGESTIVE TRACT

Ye. B. Babskiy and A. M. Sorin *In its* Mod. Tech. Advan. in Med. 19 May 1966 p 37–58 refs (See N66-26917 15-04) CFSTI: $4.00

Radiotelemetric research is discussed in terms of measurements of the digestive tract processes; and the use of radio pills, called endoradiosindes, is reviewed. These miniature radio transmitters can record changes in hydrogen ion concentrations, pressure, and temperature. Major advantage of their use is that they do not involve damage or to changes in the normal processes of the organism. Endoradiosondes are very mobile and pass along the entire digestive tract, which permits the study of the entire area, but for short periods of time. To permit longer study periods in animals, endoradiosondes have been sewn to the wall of the stomach or intestine; in man, this difficulty because of mobility has not been overcome. Design of these radio pills is discussed, along with their use in making certain recordings. M.W.R.

N66-26920# Joint Publications Research Service, Washington, D. C.

NEW METHODOLOGICAL DIRECTIONS IN ELECTROPHYSIOLOGY

R. M. Meshcherskiy *In its* Mod. Tech. Advan. in Med. 19 May 1966 p 59–77 refs (See N66-26917 15-04) CFSTI: $4.00

Sterotaxis and microelectrode research methods in electrophysiology are discussed in terms of applications for the study of the various subcortical formations of the brain and the activity of the individual neurons and their cell bodies, axons, dendrites, and synapses. Both methods are described in detail, and their uses are illustrated. The stereotactic instrument consists of a base to which is attached the head clamp and one or two coordinate micrometric heads. In the latter is the holder which introduces the electrodes into the brain of the experimental animal. Prior to this insertion, a trepanation opening is drilled; and a holding plug of plexiglas is screwed into the opening to attach the electrode to the skull. The gap between the electrode and holding plug is filled with a rapidly setting lacquer. The positioning of the animal's head, which is anesthesized, is shown. The introduction of microelectrodes into a living neuron is described, and various problems such as resistance are considered. A scheme of an automatic unit with a tracking system for remote control is shown, as are histograms of neuron discharges obtained by computer processing of data. M.W.R.

N66-26921# Joint Publications Research Service, Washington, D. C.

ARTIFICIAL BLOOD CIRCULATION

G. M. Solov'yev *In its* Mod. Tech. Advan. in Med. 19 May 1966 p 78–94 (See N66-26917 15-04) CFSTI: $4.00

Design principles for artificial blood circulation equipment are discussed; and details are given for the basic units of such simulated systems, the pumps and oxygenators. The role of hypothermy when combined with artificial blood circulation is considered in terms of developments in open heart surgery requiring lengthy operating periods. Attention is given to a method for cooling a patient to temperatures of 20° and below in 10 to 15 minutes. Cardioplegia and coronary perfusion are discussed, along with operations for congenital and acquired heart diseases. The latter covers defects of the intraurricular and interventricular septa, stenosis of the pulmonary artery, Fallot's triad and tetrad, mitral stenosis and insufficiency, and aortic defects. M.W.R.

N66-26922# Joint Publications Research Service, Washington, D. C.

ELECTRONIC MATHEMATICAL MACHINES AND MATHEMATICAL METHODS IN MEDICINE

M. L. Bykhovskiy *In its* Mod. Tech. Advan. in Med. 19 May 1966 p 95–109 refs (See N66-26917 15-04) CFSTI: $4.00

Directions for using mathematical machines to solve medical problems are discussed, and immediate propects for their use are outlined with respect to the design of diagnostic and information systems. Immediate applications of cybernetics to medicine are considered to involve creation of: (1) a common diagnostic system in the form of a broad organization of particular diagnostic systems, (2) a system to automatically evaluate conditions and control vital body functions during surgery, (3) a system which can receive both current information about the patient and data related to his past development, (4) a broad network of automated information medical information systems, (5) a means to utilize other case histories in the treatment of a patient, and (6) models of the functional systems in man under both normal and pathological conditions. M.W.R.

N66-26923# Joint Publications Research Service, Washington, D. C.

BIOELECTRIC CONTROL IN CARDIOLOGY

Ye. B. Babskiy *In its* Mod. Tech. Advan. in Med. 19 May 1966 p 110–121 refs (See N66-26917 15-04) CFSTI: $4.00

Prospects for the use of bioelectric control in experimental and clinical cardiology are discussed in a general article which considers certain theoretical aspects of the synchronization of research on heart activity with periods of excitation and the phases of the heart cycle. Methods employed are mentioned, as well as the difficulties inherent in their use. Practical aspects in applying bioelectric control are discussed, various uses of X-rays in cardiology are reviewed, and injection of drugs directly into the coronary vessels is mentioned as an application of the principle of bioelectric control. M.W.R.

N66-26924# Joint Publications Research Service, Washington, D. C.

ARTIFICIAL ARMS WITH BIOELECTRIC CONTROL

Ya. S. Yakobson, Ye. P. Polyan, and V. M Bernshteyn *In its* Mod. Tech. Advan. in Med. 19 May 1966 p 122–145 refs (See N66-26917 15-04) CFSTI: $4.00

Development of prostheses with biolectric control is considered in terms of devices, power source, and the selection of active muscles for control purposes. Special attention is given to a forearm prosthesis, and its amplifier unit is diagrammed. The hand mechanism with an electric drive is discussed in detail; and its actual use is described. It is pointed out that additional research is underway to increase the power of the grip in the hand and to permit control of individual finger movements. M.W.R.

N66-26927# Joint Publications Research Service, Washington, D. C.

STUDIES IN HIGHER NERVOUS ACTIVITY

3 May 1966 97 p refs Transl. into ENGLISH from Zh. Vysshei Nervnoi Deyatel'nosti (Moscow), v. 16, no. 1, Jan.-Feb. 1966 p 34-51, 62-66, 82-87, 96-101, 103-111 (JPRS-35315; TT-66-31751) CFSTI: $3.00

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3. PROLONGED SHIFTS OF THE STEADY POTENTIAL OF THE CORTEX IN RESPONSE TO PHOTIC AND ELECTRICAL STIMULATION OF NON-SPECIFIC BRAN STRUCTURES Zh. P. Shuranova p 28-32 refs (See N66-26929 15-04)

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6. QUANTITATIVE CHARACTERISTICS OF TEMPORAL SUMMATION IN THE POSTERIOR COLLICULI AND LATERAL LEMNISCUS OF THE RAT BRAIN I. A. Vartanyan p 52-64 refs

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8. FUNCTIONAL CHARACTERISTICS OF VISUAL CENTER NEURONS IN THE FROG IN RELATION TO INTENSITY OF PHOTIC STIMULUS p 76-79 refs (See N66-26932 15-04)

9. CONDITIONING OF AVOIDANCE AND ALIMENTARY REFLEXES TO ELECTRICAL SKIN STIMULATION M. I. Tashmukhamedova p 80-83 refs (See N66-26933 15-04)

10. EFFECT OF INTERMITTENT PHOTIC STIMULATION ON HIGHER NERVOUS ACTIVITY OF DOGS N. N. Kudryavtseva p 84-86 refs (See N66-26934 15-04)

N66-26928# Joint Publications Research Service, Washington, D. C.

ELABORATION OF A VASCULAR CONDITIONED REFLEX IN MAN TO A CHANGE IN THE TENSION OF AN ELECTROMAGNETIC FIELD OF HIGH FREQUENCY

G. F. Plakhanov and V. V. Vedyushkina *In its* Studies in Higher Nervous Activity 3 May 1966 p 1-6 refs (See N66-26927 15-04) CFSTI: $3.00

The effects of changes in electromagnetic field on the vascular conditioned reflex was investigated using a plethysmographic method. The conditioned stimulus was the change in tension of a high frequency electromagnetic field generated by a portable diathermy apparatus having a basic frequency of 735 kilocycles per second. A baseline was established when the wrists and one third of the forearm were placed in a plethysmograph with warm water (35° C). Then, as the unconditioned stimulus, cold water (4°C) was passed through a copper coil on the left hand of the subject. After shutting off the stimuli, warm water (35° C) was passed through the coil for 15-20 seconds. It was noticed that capacitance coupling as the experimenter's hand approached the apparatus noticeably increased the field intensity. Tests were conducted to determine the effect of rotation of the apparatus, and of connecting the wire to the terminal lead. Graphs of the data are included. Clear-cut conditioned reflex constriction of the vessels was obtained. The possible effects of the apparatus on the results are discussed. N.E.N.

N66-26929# Joint Publications Research Service, Washington, D. C.

PROLONGED SHIFTS OF THE STEADY POTENTIAL OF THE CORTEX IN RESPONSE TO PHOTIC AND ELECTRICAL STIMULATION OF NON-SPECIFIC BRAIN STRUCTURES

Zh. P. Shuranova *In its* Studies in Higher Nervous Activity 3 May 1966 p 28-32 refs (See N66-26927 15-04) CFSTI: $3.00

Photic and electrical stimulation experiments were conducted on rabbits to investigate bioelectrical activity on the surface and in deep layers of the cortex. Details of the preparation and instrumentation are given. The responses to rhythmical photic stimulation in the visual cortex were found to be of two basic forms: (1) a slow potential shift, negative at the surface and positive deep in the cortex, whose duration usually corresponded to the duration of stimulation; and (2) a slow shift of potential, negative both on the surface and deep in the cortex, which usually lasted longer than the period of stimulation. The response recorded in the cortex upon low frequency electrical stimulation of the medial thalamus in its vertical distribution showed a similarity to the first photic response. A high frequency stimulation produced a response similar to the second photic response. It was concluded that prolonged, photic stimulated potential shifts are nonuniform in origin and may be related predominantly to excitation of the medial thalamus or to activation of the brain stem reticular formation. N.E.N.

N66-26930# Joint Publications Research Service, Washington, D. C.

DIFFERENTIAL SENSITIVITY OF KINESTHETIC AND THERMAL ANALYZERS IN HEALTHY PERSONS AND IN PATIENTS SUFFERING FROM NEUROGENIC CARDIOVASCULAR DISORDERS

A. V. Zav'yalov *In its* Studies in Higher Nervous Activity 3 May 1966 p 42-51 refs (See N66-26927 15-04) CFSTI: $3.00

Muscular and thermal differential sensitivity was investigated in healthy subjects and in patients with neurocirculatory dystonia or hypertension. For studying kinesthesia, the subject held a polyethylene bag, and water was admitted slowly until the subject no longer perceived a slight increase in weight. In the thermal sensitivity test, the subject placed the palm of his hand on a disk formed by several coils of rubber tubing through which increasingly water was passed. The subject noted each minimal temperature increment perceived. Graphs of the data are presented. Among the conclusions are: the variability of temperature sensitivity is significantly above the variability of muscular sensitivity; in patients of both groups there was a marked reduction in muscular sensitivity and an increase in its variability over the healthy subjects; and furthermore, in patients with hypertension, a substantial reduction in temperature sensitivity was noticed. N.E.N.

N66-26931# Joint Publications Research Service, Washington, D. C.

PRIMARY POTENTIALS IN ANIMALS IRRADIATED DURING THE ANTENATAL PERIOD

A. M. Ivanitskiy *In its* Studies in Higher Nervous Activity 3 May 1966 p 65–75 refs (See N66-26927 15-04) CFSTI: $3.00

The primary response of the cerebral cortex in rabbits irradiated in embryonic development was examined. Two groups of rabbits were irradiated with a dose of 400 r at 20 r/min, one group on the 15th day and the other on the 23rd day. A third group was used as a control. The electrodes were implanted intradermally or extradurally over the visual cortex, and the operation was performed under nembutal narcosis. Potentials were recorded on a 4-channel electroencephalograph. Within the control group, the primary response was of the classical positive and negative phases, approximately equal in amplitude. In the rabbits irradiated on the 15th day, only slight differences were noticed: some prolongation of the latent period of the response and an increase in its amplitude. In the animals irradiated on the 23rd day, it was observed that: the positive phase was significantly reduced; immediately following the primary response there was a profound fluctuation approximating the negative phase amplitude; and nembutal produced a shift toward normalization in the primary response. N.E.N.

N66-26932 Joint Publications Research Service, Washington, D. C.

FUNCTIONAL CHARACTERISTICS OF VISUAL CENTER NEURONS IN THE FROG IN RELATION TO INTENSITY OF PHOTIC STIMULUS

L. I. Mkrtycheva and V. G. Samsonova *In its* Studies in Higher Nervous Activity 3 May 1966 p 76–79 refs (See N66-26927 15-04) CFSTI: $3.00

The impulse activity of silent neurons of the roof of the mid-brain in curarized frogs in the presence of photic stimulation was investigated. The electrical response was recorded extracellularly by a glass microelectrode, and the flash intensity was altered by an optical wedge and neutral filters. Most silent neurons of the tectum responded to energy of the order of 1 lumen-second, but a few cells responded only to 10 lum-sec or more. It was observed that most cells responded to a lower energy level than most of the cells with long latency and the rapidly adapting units. The tectum cells differ also with respect to their ability to respond to an increase in the discharge frequency in a limited range of photic energy. The range for slowly adapting units was broader than for rapidly adapting units. Graphs are presented for the neuron distributions with respect to light stimuli and with respect to the range of light energy producing augmentation of cell activity. N.E.N.

N66-26933# Joint Publications Research Service, Washington, D. C.

CONDITIONING OF AVOIDANCE AND ALIMENTARY REFLEXES TO ELECTRICAL SKIN STIMULATION

M. I. Tashmukhamedova *In its* Studies in Higher Nervous Activity 3 May 1966 p 80–83 refs (See N66-26927 15-04) CFSTI: $3.00

A defensive reflex of avoidance and alimentary conditoned reflex to electrical skin stimulation in dogs was investigated. The stimulus, a direct current applied to the right anterior paw, ceased upon elevation of the paw to an established height. The food, a meat–sugar powder with cooked meat, was supplied 2.5 or 10 seconds following the circuit break. Variations in the approach are given, and graphs of conditioned avoidance are included. It was concluded that electrical skin stimulation evoked a conditioned protective reflex of the stimulated paw and also an alimentary conditioned reflex. N.E.N.

N66-26934# Joint Publications Research Service, Washington, D. C.

EFFECT OF INTERMITTENT PHOTIC STIMULATION ON HIGHER NERVOUS ACTIVITY OF DOGS

N. N. Kudryavtseva *In its* Studies in Higher Nervous Activity 3 May 1966 p 84–86 refs (See N66-26927 15-04) CFSTI: $3.00

The higher nervous activity in dogs in the presence of intermittent photic stimulation was investigated and compared to the effects of constant intensified illumination. Dogs studied under constant illumination were used, and tests were arranged according to a salivary food method. After a given level of conditioned reflexes had been established (positive at 300 beats/min and inhibitory at 60 beats/min), tests were conducted with a background of constantly operating intermittent light of different energies. Two experiments were done: (1) with a flash frequency of 3 flashes/sec synchronously to both eyes, and (2) a frequency of 3 and 5 flashes asynchronously to the opposite eyes. Tabulated data is presented and the results discussed. It was concluded that additional stimulation in the form of light flashes creates difficult conditions for the nervous system of dogs. N.E.N.

N66-26966# Joint Publications Research Service, Washington, D. C.

STUDIES IN OCCUPATIONAL DISEASES

26 May 1966 12 p Transl. into ENGLISH from Med. Gazeta (Moscow), Mar. 1966

(JPRS-35717; TT-66-32152) CFSTI: $1.00

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N66-26967# Joint Publications Research Service, Washington, D. C.

PHOSPHOLIPID METABOLISM AND MINUTE HEART VOLUME

17 Feb. 1966 19 p refs Transl. into ENGLISH from Byull. Eksptl. Biol. i Med. (Moscow), v. 60, no. 11, Nov. 1965 p 50–53, 118–121

(JPRS-34191; TT-66-30632) CFSTI: $1.00

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2. A METHOD FOR RECORDING MINUTE HEART VOLUME IN RABBITS USING PHOSPHORUS-32 K. M. Ester and V. I. Kandror p 6–12 refs (See N66-26969 15-04)

N66-26968# Joint Publications Research Service, Washington, D. C.

PHOSPHOLIPID METABOLISM IN THE RAT BRAIN DURING HYPOXIA AND DURING THE POST-HYPOXIC PERIOD

V. Ya. Dvorkin and I. P. Pavlov *In its* Phospholipid Metab. and Minute Heart Vol. 17 Feb. 1966 p 1–5 refs (See N66-26967 15-04) CFSTI: $1.00

For this investigation, the animals were given subcutaneous injections of radioactive phosphate, and placed in a pressure chamber. The phospholipids of the rat cerebral hemispheres were divided into five fractions, and determinations

were made of the phosphorous content, and its specific radioactivity in each fraction. A table which summarizes the data obtained is provided. This table shows a decrease in the relative specific radioactivity of the phosphatide acid and the polyglycerophosphatide fractions. A greater decrease was found in the aminophospholipid and sphingomyelin fractions. The maximum decrease was observed in the phosphoinositide and phosphatidylcholine fractions. These and additional results are discussed briefly. H.S.W.

N66-26969# Joint Publications Research Service, Washington, D. C.

A METHOD FOR RECORDING MINUTE HEART VOLUME IN RABBITS USING PHOSPHORUS-32

K. M. Ester and V. I. Kandror *In its* Phospholipid Metab. and Minute Heart Vol. 17 Feb. 1966 p 8–12 refs (See N66-26967 15-04) CFSTI: $1.00

Existing experimental methods for determining the minute heart volume of small animals using beta and gamma ray sources required frequent blood letting, thereby introducing errors into the readings. A method is described, using P^{32} as a beta emitter, which allows measurements to be made with the heart still intact. This method requires obtaining a curve of the changes in the concentration of the isotope, at a particular point of the arterial bed, after it has been injected into a vein. To assure prolonged retention of P^{32} in the vascular bed, the erythrocytes were labeled with radioactive phosphorus. Additional details of the process are given; some results of an experiment conducted using this method are provided; and its value is assessed. H.S.W.

N66-27037*# Aeronutronic, Newport Beach, Calif.

EXPERIMENTAL STUDIES FOR THE DETECTION OF PROTEIN IN TRACE AMOUNTS Quarterly Status Report, 1 Mar.–31 May 1965

E. R. Walwick, J. D. Albert, and B. R. Zalite [1965] 6 p ref (Contract NASw-770)

(NASA-CR-64051; U-3156) CFSTI: HC $1.00/MF $0.50 CSCL 06A

Research was conducted on methods to extract and prepare organic materials from soils; and the interaction of these materials with thiacarbocyanine was investigated. The approach was: (1) to determine the tendency of inorganic polyanions which form or are stable in aqueous systems to change the dye spectrum; and (2) to observe the reaction of the dye with soluble and colloidal inorganic polyanions extractable from soil. In addition, a method was developed to separate inorganic compounds from the polymeric organic materials, while maintaining an optimum extraction of the organic material. The procedures are described; and some preliminary results are presented. D.T.

N66-27041*# Stanford Univ., Calif. Biophysics Lab.

PHOTOCHEMISTRY OF DL-PHENYLALANINE

Dean H. Kenyon Dec. 1964 151 p refs

(Grants NSG-218-62; NIH-GMS-2G-712-C3; NIH-GMS-2G-712-C2)

(NASA-CR-57741; BL-124) CFSTI: HC $5.00/MF $1.00 CSCL 06A

A detailed, quantitative investigation of DL-phenylalanine photochemistry was undertaken. The experimental procedures and characterizations are described. By using paper chromatographic solvent systems, several photoproducts were identified. The kinetics of photoproduct accumulation and phenylalanine loss were determined for oxygen-saturated and oxygen-free solutions and under several conditions. The data were used to estimate quantum yields. Among the conclusions are: photoexcitation energy initially confined to the benzene ring can be subsequently transferred to the side chain; the most labile side chain carbon–carbon bond is that between the carboxyl and alpha carbons; molecular oxygen is required for the synthesis of tyrosine, DOPA, and the photopolymer; the optical density increases, occurring in uv-irradiated solutions of phenylalanine, are associated with the synthesis of photopolymer; and several different free radical species are formed as primary photodissociation products of phenylalanine. N.E.N.

N66-27133# Vitro Engineering Co., New York.

USE OF RADIATION TECHNIQUES FOR THE INHIBITION OF BACTERIAL GROWTH IN LIQUID MEDIA

S. K. Hellman Washington, AEC, 15 Jul. 1965 47 p refs (Contract AT(30-1)-3331)

(KLX-1672) CFSTI: HC $2.00/MF $0.75

An initial feasibility study of the use of low dose irradiation for inhibiting bacterial growth in liquid media is presented. The proposed technique is based on applying these low doses periodically, on a scheduled basis, so as to prevent the bacteria population from increasing, thus achieving a steady-state bacteria level over a long period of time. Although there are many applications for the use of low dose irradiation to inhibit bacterial growth in liquid media, the problem of bacteria in jet fuel wing tanks is considered for development of a conceptual irradiation unit design. The basis for the irradiation requirement of the fuel is an experimental program conducted, on a laboratory scale, at the University of Maryland's Gamma Facility. A culture Pseudomonas aeruginosa was used to prepare the simulated media. The experiments clearly indicated that control can be achieved at low dosages. However, the actual level depends on the growth rate of the bacteria and the cycle time between doses. It was possible to develop a mathematical correlation from these experiments, suitable for use as a basis for a conceptual design analysis of a commercial irradiation unit for on board treatment of fuel jet aircraft. The particular application under consideration was related to the needs of one specific airline. A conceptual design of a Mobile Fuel Irradiator (MFI) would be capable of treating the fuel in two Boeing-707 type aircraft wing tanks each night was developed. Economically, the technique was determined to be feasible. Areas needing further verification are indicated. Positive results in these experiments would implicate the design and fabrication of commercial units. NSA

N66-27144# Agricultural and Technical Coll. of North Carolina, Greensboro.

BIOCHEMICAL AND IMMUNOLOGICAL STUDIES OF X-IRRADIATED MICE FOLLOWING BONE MARROW INJECTIONS

George C. Royal, Jr. and Gladys W. Royal 27 Oct. 1965 7 p

(Contract AT(40-1)-2399)

(TID-22466) CFSTI: HC $1.00/HC $0.50

Body weight, proteins, viscosity, and serotonin decreased in mouse organs following LD_{100} x-irradiation. Isologous bone marrow therapy acted as a control mechanism, while heterologous (rat) bone marrow therapy reflected inherent biological variation which was detectable in larger standard deviations of relevant parameters. Some rat bone marrow samples offered immediate injection mortality. Thirty percent survival among x-irradiated hosts was usual for rat marrow treated mice. Tibia bovine bone marrow contains some agent or agents apparently capable of circumventing the normal x-irradiation response through an unspecified, altered glycolipid metabolism. Details of glycolipid metabolism are desirable to explain the

specifics of this hypothesis. The effective agent in bovine marrow therapy for x-irradiated mice appears to be glycolipid generally, and galactolipid specifically; with an implied interrelationship between brain and spleen metabolism during the response to irradiation injury. Author (NSA)

N66-27201*# National Aeronautics and Space Administration, Washington, D. C.

ON PAROXYSMAL AURICULAR FIBRILLATION IN PATIENTS WITH ATHEROSCLEROTIC CARDIOSCLEROSIS [O PRISTUPOOBRAZNOY FORME MERTSATEL'NOY ARITMII U BOL'NYKH ATEROSKLEROTICHESKIM KARDIOSKLEROZOM]

Z. M. Volynskiy and V. S. Solov'yeva Nov. 1963 10 p refs Transl. into ENGLISH from Terap. Arkh. (Moscow), v. 33, no. 7, Jul. 1961 p 10-16

(NASA-TT-8557) CFSTI: HC $1.00/MF $0.50 CSCL 06E

Paroxysmal auricular fibrillation in patients with atherosclerotic cardiosclerosis develops most frequently in connection with acute transitory, or more prolonged, disturbances of the coronary circulation. Other factors, as pneumonia, disturbances of the gastrointestinal tract, etc., play a less frequent role. In these cases, the anatomo-physiological basis for paroxysmal auricular fibrillation is either transient ischemia of the auricular muscle, overexertion of the auricular muscle in connection with the impairment of circulation in the ventricular muscle, or their overexertion due to a diminished output in the lesser circulation during inflammatory pulmonary processes. It is quite possible that there is a reflex action on the auricular muscle by different internal organs. Any one of these factors, or a combination of them, can bring about the development of multiple foci of excitability in the auricular muscle. Author

N66-27259# Los Alamos Scientific Lab., N. Mex.

COMPUTER ANALYSIS OF CELL VOLUME DISTRIBUTIONS

Phillip N. Dean 7 Feb. 1966 51 p refs

(Contract W-7405-ENG-36)

(LA-3440) CFSTI: HC $3.00/MF $0.50

Two computer programs were written to analyze blood cell volume distributions measured with a Coulter type of cell spectrometer. One of the programs, called AVOL, is used to calculate the mean cell volume of any type of distribution and to plot the data in various formats. The other program, called CELVOL, uses an iterative least-squares technique to fit either normal, log-normal, or skewed-normal distributions to the data. Either single- or double-peak distributions can be fitted. The program also converts the results of the fit to cell concentration in each peak in cells per cubic millimeter, standard deviation in cubic microns, and mean cell volume in cubic microns. For red blood cells the mean cell volume is also calculated from the hematocrit and included in the data output listing. Author (NSA)

N66-27319*# Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.

HUMAN RESPONSE TO SUSTAINED ACCELERATION

T. M. Fraser Washington, NASA, 1966 137 p refs

(Contract NASR-115)

(NASA-SP-103) GPO: HC $1.00; CFSTI: MF $1.00 CSCL 06S

Literature dealing with human response to sustained acceleration is critically reviewed, and an annotated bibliography of all reference material is presented. The natural history of exposure to sustained acceleration is described, and the physiological effects, tolerance thresholds, and performance capacities are delineated. Among the broad conclusions which were drawn from the review are: (1) The basic physiological response to sustained acceleration in all vectors depends primarily on the development of a hydrostatic pressure head related to the magnitude of the acceleration. (2) The development of compensatory measures requires about 5 seconds, and is influenced by the rate of onset of acceleration. (3) In the positive and negative vector, retinal and cerebral circulation effects are observed; in the transverse vector, respiratory effects occur, although the development of alveolar shunts is probably physiologically more significant. In the lateral vector, physiological shunts and arterial desaturation may be important. (4) The cellular response appears to represent the response to hypoxemia or to general stress. Areas of limited data are pointed out, and recommendations for specific research are proposed. M.G.J.

N66-27343# Istituto Diricerche Farmacologiche (Mario Negri), Milan (Italy).

SELECTIVE PROTECTION OF DAMAGES INDUCED BY X-IRRADIATION AND RADIOMIMETIC DRUGS Progress Report, 1 Nov. 1964-31 Jan. 1965

S. Garattini, V. Palma, I. Reyers-Degli Innocenti, and A. Guaitani [1965] 8 p ref

(Contract IAEA-204/RB)

(NP-15666)

Studies were made to determine in a clear and reproducible way the conditions in which radioprotector drugs interact with alkylating agents in tumor-bearing mice. However, only negative data are reported. The drugs tested were: serotonin creatinine sulfate; L-cysteine; cysteamine-HCl; thiourea; AET; 2-methyl-piperazine-dithioformic acid; morpholine salt of morpholino-dithioformic acid. Cyclophosphamide and DL-sarcolysine were used as radiomimetic agents. Data are tabulated. NSA

N66-27345# Istituto di Ricerche Farmacologiche (Mario Negri), Milan (Italy).

SELECTIVE PROTECTION OF DAMAGES INDUCED BY X-IRRADIATION AND RADIOMIMETIC DRUGS Final Report

S. Garattini, V. Palma, I. Reyers-Degli Innocenti, and A. Guaitani 30 Sep. 1965 23 p refs *Its* Rept.-4

(Contract IAEA-204/RB)

(NP-15668)

Studies were made on the interaction of several radio-protectors with different antitumoral agents in two experimental tumors, namely, sarcoma 180 and Ehrlich carcinoma transplanted in mice in the solid form. The radioprotectors used were: serotonin creatinine sulfate; L-cysteine; cysteamine; thiourea; AET; 2-methylpiperazinedithioformic acid; and morpholine salt of morpholinodithioformic acid. The antitumoral drugs were: DL-sarcolysine; 2,4,6-*tris*(1-aziridinyl)-, *s*-triazine; 2,2'-dichloro-*N*-methyl-diethylamine; *N,N-bis*(2-chloroethyl)alanine; 5-fluorouracil; Mitomycin C; Vinkaleucoblastine sulfate; and cyclophosphamide. It was concluded that indiscriminate use of radioprotectors in combination with radiomimetic drugs and, possibly, with irradiation, are not useful to achieve better antitumoral effect and even disadvantageous because of the antagonism toward the antitumoral activity of radiomimetic drugs. 58 references are cited. NSA

N66-27358# Oak Ridge National Lab., Tenn. Health Physics Div.

A COMPUTER CODE FOR ESTIMATION OF BODY BURDEN OF ^{90}Sr BASED ON O.R. AND BONE REMODELING WHICH ARE AGE DEPENDENT

Henry L. Fisher, Jr. [1965] 14 p refs Presented at the Ann. Bio-Assay Meeting, Albuquerque, N. Mex.
(Contract W-7405-ENG-26)
(ORNL-P-1830; CONF-651008-5) CFSTI: HC $1.00/MF $0.50

A computer code for analysis of data on ^{90}Sr metabolism as a function of age was developed. A model for estimating ^{90}Sr body burden and metabolism as a function of age of the individual is described. In the model the skeleton is considered as a single compartment with a simple constant turnover rate coefficient for each age of the individual, and any recycling or exchange of Sr between various parts of the body is neglected. The results using the model were compared with others by applying it to several simple cases. NSA

N66-27386# California Univ., Berkeley. Lawrence Radiation Lab.
PHOTOBIOCHEMISTRY—DEHYDRATION CONDENSATION IN AQUEOUS SOLUTION
Gary David Steinman (Ph. D. Thesis) Jan. 1966 211 p refs
(Contract W-7405-ENG-48)
(UCRL-16566) CFSTI: HC $6.00/MF $1.25

The results reported from many laboratories over the past decade make it clear that monomers necessary for biogenesis could have been formed under conditions believed to have existed on the primitive Earth. Mechanisms by which the biological monomers may have condensed in aqueous solution to produce more complex compounds, such as phosphates, acetates, pyrophosphates and peptides are discussed with emphasis on the role of dicyandiamide and dicyanamide in the types of condensations occurring on the primitive Earth. Results are reported from studies of the mechanism of dipeptide synthesis promoted by dicyanamide under conditions of simple, relatively stable reactants, moderate temperature, and dilute, aqueous solutions. It is postulated that this study demonstrates one means by which essential biochemicals could have been formed on the primitive Earth, thus providing materials needed for the origin of living systems. NSA

N66-27468# Yugoslav Academy of Sciences and Arts, Zagreb. Inst. for Medical Research.
A STUDY OF THE MECHANISM OF INITIAL RADIATION EFFECTS Final Report, Nov. 1, 1963–Oct. 31, 1965
Yvette Skreb [1965] 44 p refs *Its* Rept.-6
(Contract IAEA-217/RI/RB)
(NP-15855)

Results are reported from studies on the effects of γ and uv radiations on the content of DNA, RNA, and proteins in whole amoeba, amoeba fragments with the nucleus, and amoeba fragments without the nucleus at various time intervals after exposure. The uptake of ^{14}C-adenine, ^{14}C-phenylalanine, ^{14}C-uracil, ^{3}H-cytidine, and ^{3}H-thymidine during the synthesis of these constituents were followed autoradiographically. NSA

N66-27481# General Motors Corp., Santa Barbara, Calif. Defense Research Labs.
BATHYPHOTOMETRIC STUDIES OF THE LIGHT REGIME OF ORGANISMS OF THE DEEP SCATTERING LAYERS Final Report
William D. Clarke Jan. 1966 50 p refs
(Contract AT(04-3)-584)
(SAN-584-1; TR-66-02) CFSTI: HC $2.00/MF $0.50

The swimming capabilities of marine organisms make them important agents for the distribution and transportation of radioisotopes. Since the organisms associated with the deep scattering layers of the ocean move across density gradients such as the thermocline and the halocline, which normally inhibit physical mixing, and since these organisms provide forage for commercially-harvested fish, they may transfer radioactive substances from ocean waters to the food-chain of man. Results are reported from a study of the migrating mesopelagic organisms associated with the deep scattering layers of the Santa Barbara Channel, Calif. This area is part of that studied by the AEC in connection with the Vandenberg Air Force Base missile launching site. The principal phylogenic groups of migrating organisms were sampled at constant light levels, or isolumas, and plankton were sampled from the different strata of water between the maximum sampling depths and the surface. Sampling methods and equipment are described in detail. The migrating mesopelagic organisms associated with the deep scattering layers of the Santa Barbara Channel appear to form a series of partially overlapping layers that are correlated most closely with light intensity in their vertical distributions. Data are included on the distribution of the various species found. NSA

N66-27488*# Republic Aviation Corp., Farmingdale, N. Y.
STUDY OF THE NORMAL FECAL BACTERIAL FLORA OF MAN
Lorraine S. Gall Washington, NASA, Jun. 1966 170 p refs
(Contract NASw-738)
(NASA-CR-467) CFSTI: HC $5.00/MF $1.00 CSCL 06M

In order to obtain baseline data for evaluating the effect of space flight on the fecal flora, aerobic and anaerobic microbiological studies were conducted on a series of fecal samples taken from 25 adult men. The predominating bacteria were isolated for morphological and physiological examination. The methods used for collection, isolation, characterization, and study are described, and details are given on the procedures which deviated from the standard technique. Sixteen type cultures, representing the most frequently occurring strict anaerobes isolated, were studied to assess their possible role in the body; results indicate that certain of these cultures can carry out many major processes associated with digestion, including the metabolism of certain carbohydrates, fats, and proteins, and the production of certain B vitamins. It was also established that anaerobes outnumber aerobes by 1000 to 10,000, and that strictly anaerobic bacteria rather than facultative anaerobes compose over 90% of the most predominating microorganisms. M.G.J.

N66-27495*# National Aeronautics and Space Administration, Washington, D. C.
METHODS OF INVESTIGATING THE VESTIBULAR APPARATUS [METODY ISSLEDOVANIYA VESTIBULYARNOGO APPARATA]
R. M. Bayevskiy May 1966 11 p Transl. into ENGLISH from the publ. "Fiziologicheskiye Metody v Kosmonavtike" Moscow, Izd. "Nauka", 1965 p 246–250
(NASA-TT-F-10125) CFSTI: HC $1.00/MF $0.50 CSCL 06P

Following the discovery of vestibulo-vegative and vestibulo-sensory disorders during a manned Soviet space flight, the characterization of the functional state of the vestibular apparatus was included in physiological measurements. To evaluate the reflex changes produced by vestibular stimulations, the electrooculographic method was used. It is reported that nystagmus is one of the constant reflex reactions of striated muscles, and this method may be used to record nystagmic oscillations. The problems inherent in obtaining recordings by this method are discussed, and a technique is described which uses detachable electrodes located near the

external ocular angles that are connected to amplifiers by push button connectors extended to the helmet. The data derived from this technique makes it possible to evaluate the oculomotor reactions, oculomotor activity, vocal reactions, and the control of nystagmic reactions. This method was used in four flights and the results of obtaining physiological data by this means are assessed. H.S.W.

N66-27500*# National Aeronautics and Space Administration, Washington, D. C.

BIOLOGICAL MECHANISMS OF OXALACETIC ACID DECARBOXYLATION [BIOLOGICHESKIYE MEKHANIZMY DEKARBOKSILIROVANIYA SHCHAVELEVOU KSUSNOY KISLOTY]

N. K. Nagradova May 1966 37 p refs Transl. into ENGLISH from Usp. Sovrem. Biol. (Moscow), v. 52, no. 1 (4), 1961 p 3–18

(NASA-TT-F-10143) CFSTI: HC $2.00/MF $0.50 CSCL 06A

Biological mechanisms of oxalacetic acid decarboxylation are reviewed on the basis of reported data. The associated process of CO_2 fixation is also extensively discussed, particularly in terms of the role of malic enzyme, which plays a predominant part in the formation of dicarboxylic acids in both plant and animal tissues. The interrelationships of the various reactions of oxalacetic acid decarboxylation are presented and an overall diagram of these reactions is given. The action of the Utter-Kurahashi enzyme, phosphorylenolpyruvate carboxylase, and other carboxylases of oxalacetic acid involved in the formation of oxalacetic or its decarboxylation is discussed; and a mechanism of the decarboxylation is presented. The role of biotin in this process is also discussed, as well as the relation of oxalacetic acid conversions to the synthesis of glycogen. Author

N66-27501*# National Aeronautics and Space Administration, Washington, D. C.

PHYSIOLOGY OF WATER AND SODIUM CHLORIDE [ZUR PHYSIOLOGIE DES WASSERS UND DES KOCHSALZES]

O. Cohnheim, G. Kreglinger, L. Tobler, and O. H. Weber May 1966 35 p refs Transl. into ENGLISH from Z. Physiol. Chem. (Berlin), v. 78, 1912 p 62–88

(NASA-TT-F-10146) CFSTI: HC $2.00/MF $0.50 CSCL 06S

Results of experiments on sodium chloride excretion of the human organism at high altitudes during physical exertion, at rest, and with low- and high-salt diets are discussed. Sodium chloride depletion and concomitant permanent weight loss was observed only during profuse perspiration. Excessive chlorine loss led to reduction of gastric HCl secretion with resultant muscular fatigue due to impaired deacidification of the tissues. Author

N66-27506# Atomic Energy Commission, Oak Ridge, Tenn. Div. of Technical Information Extension.

PHYSIOLOGICAL STUDIES EMPLOYING RADIOISOTOPES

Helen L. Ward, comp. May 1965 309 p refs

(TID-3515, Suppl. 1) CFSTI: HC $6.00/MF $1.50

References (2578) on the use of radioisotopes in physiological studies are given to scientific literature published during the period 1958–1963. Separate author, isotope, and report number indexes are included. Author (NSA)

N66-27512# California Univ., Livermore. Lawrence Radiation Lab.

PROGRAM BOOK FOR THE ADVISORY COMMITTEE FOR BIOLOGY AND MEDICINE OF THE UNITED STATES ATOMIC ENERGY COMMISSION, PART II

10 Mar. 1966 177 p refs

(Contract W-7405-ENG-48)

(UCRL-14739, Pt. 2) CFSTI: HC $5.00/MF $1.00

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N66-27536*# Exotech, Inc., Alexandria, Va.

A STOCHASTIC STERILIZATION MODEL

Samuel Schalkowsky and Robert Wiederkehr 6 May 1966 26 p refs

(Contract NASw-1340)

(NASA-CR-75383; TR-13) CFSTI: HC $2.00/MF $0.50 CSCL 06M

An analytical framework is provided to relate pertinent aspects of the experimental determination of microbial resistance to sterilization on the one hand and to the parameters which enter into the definition of operational sterilization requirements on the other. This analytical model differs from existing models in that it is applicable to any resistance function, e.g., the survivor curve need not be exponential. The model is used to correlate the results from survivor counting tests to sampling tests (end-point) and to evaluate the validity of extrapolating from survivor data to low probabilities of contamination when the latter are specified in a number of alternate ways. Author

N66-27539*# California Univ., Los Angeles. Space Biology Lab.

ANALYSIS OF BRAIN WAVE RECORDS FROM GEMINI FLIGHT GT-7 BY COMPUTATIONS TO BE USED IN A THIRTY DAY PRIMATE FLIGHT

W. R. Adey, R. T. Kado, and D. O. Walter [1966] 49 p refs

(Grants NsG-2503; NsG-502; NsG-505; AF-AFOSR-246-63; AF-AFOSR-61-61 et al)

(NASA-CR-75337) CFSTI: HC $2.00/MF $0.50 CSCL 06B

Recent developments in acquisition and analysis of electroencephalographic (EEG) data are reviewed, in the frame of their use for physiological monitoring in space flight. The application of spectral analysis, with calculation of coherence functions, is described, and display techniques for compression of long epochs of analysis are reviewed. Results of baseline analyses from a population of 50 astronaut candidates and simple pattern recognition techniques suited to on-line flight monitoring are described. Development toward a 30-day biosatellite flight with a 6.8Kg pigtail macaque monkey are evaluated. Instrumentation will include electroencephalographic, electro-oculographic, and electromyographic implantation, blood pressure transducers in heart chambers and great vessels. Urinary collection procedures will allow inflight analysis. Author

N66-27563# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

CRITICAL STUDY OF SOME SOFT-TISSUE EQUIVALENT MATERIAL. SENSITIVITY TO NEUTRONS OF 1 KeV TO 14 MeV [ETUDE CRITIQUE DE QUELQUES MATERIAUX EQUIVALENTS AUX TISSUS MOUS. SENSIBILITE AUX NEUTRONS DE 1 KeV A 14 MeV]

Herve De Kerviler, Lucien Pages, and Philippe Tardy-Joubert Jul. 1965 14 p refs In FRENCH

(CEA-R-2833)

The elastic and inelastic reactions of various elements contributing to kerma in standard soft tissue of mice were studied and as a function of neutron energy from 1 Kev to 14 Mev. The ratio of kerma in tissue equivalent material to kerma in soft tissue was also measured. The results of calculations are presented for materials without hydrogen in order to state exactly their neutron sensitivity and for the following hydrogenous materials: Rossi and Failla plastic, MixD, pure polyethylene, and a new CEA tissue equivalent material, a magnesium fluoride and polyethylene compound. Results for γ rays are included. Author (NSA)

N66-27580# Max-Planck-Institut für Biophysik, Frankfurt am Main (West Germany). Zentralstelle für Atomkernenergie-Dokumentation.

RADIATION EFFECTS ON LIVING TISSUES AND ORGANISMS. SERIES C: BIBLIOGRAPHIES

W. Stahlhofen, comp. Jun. 1965 168 p refs *Its* No. 20

(AED-C-04-20)

References (563) are given to reports, books, and journals published from 1962 through 1964. Separate author, report number, and subject indexes are included. NSA

N66-27595# Naval Radiological Defense Lab., San Francisco, Calif.

AN ULTRASTRUCTURAL STUDY OF THE DEVELOPMENT OF RADIATION INJURY IN THE LUNG

Theodore L. Phillips 1 Feb. 1966 23 p refs

(USNRDL-TR-973; AD-630870) CFSTI: HC $2.60/MF $0.50

Radiation doses of 2000 R were given to the left hemithorax of a group of 25 rats. At invervals of from one hour to one year following irradiation sections of the lung were examined with the electron microscope. The initial site of radiation damage appears to lie chiefly in the endothelium. The endothelium is sloughed and the original endothelial space is replaced by collagen and mast cell infiltrates. Some capillaries are recanalized by new endothelial cells. Eventually these capillaries attain an appearance similar to that of the original capillary but with a slightly thickened endothelium and basement membrane. If the original capillary architecture is not maintained, massive fibrosis results. The mast cell participates extensively in the repair of the radiation damage and is closely associated with collagen and new capillary formation. It is stressed that the degree of damage occurring after a given dose of irradiation varies widely and that these observations were made on only small samples of lungs. Author (TAB)

N66-27603# Georgetown Univ., Washington, D. C. Dept. of Biology.

PERFORMANCE OF SMALL MAMMALS AT LOW BODY TEMPERATURES Progress Report

Joseph A. Panuska 10 Apr. 1966 27 p refs

(Contract DA-49-193-MD-2668)

(AD-630707) CFSTI: HC $2.00/MF $0.50

The effect of low body temperature on trained performance was determined, and the causes of performance failure at critical body temperature levels were analyzed. The behavioral analysis included heat reinforcement and shock escape operant procedures. The critical body temperature for performance for the hypothermic rat was bound to be 23°–25° C, several degrees C above the level of complete motor collapse. The hamster, a hibernator, showed greater variation in its hypothermic response and failed to perform at lower body temperatures than the rat. Physiological studies were begun on chronically cannulated unrestrained rats during progressive hypothermia and during rewarming. Blood pressures and heart rate were significantly different at certain corresponding temperature ranges during cooling and rewarming phases. Chronically cannulated but anesthetized control rats had consistently lower systolic and diastolic pressures and heart rates during the entire cooling process. A supplementary study on Dimethyl sulfoxide administered IP (3 or 6 g/kg in saline) revealed a significant temperature regulation disturbance at ambient temperatures of 1° 15° and 25° C. Exposure of DMSO treated subjects to 1° C resulted in deep hypothermia for all, at 15° C one-third cooled to ambient temperature. At 25°C, there was a body temperature depression of 3.6°C. It appears, however, that the critical body temperature for performance was not affected by these doses of DMSO. Author (TAB)

N66-27609# Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn.

CORRELOGRAPHIC ANALYSIS OF AFFERENT AND EFFERENT ACTIVITY DURING THE JERK REFLEX Final Technical Report, May 1964–Jun. 1965

James U. Casby and Nils A. Norman Wright-Patterson AFB, Ohio, AMRL, Dec. 1965 53 p refs

(Contract AF 33(615)-1783)

(AMRL-TR-65-171; AD-631487) CFSTI: HC $3.00/MF $0.50

Cross-correlation techniques were applied to an analysis of the afferent and efferent nerve traffic associated with the ankle jerk reflex. Primary afferent, secondary afferent and Golgi tendon fiber activity could be detected and monitored and the time course of their activity is shown. The alpha efferent activity could be monitored also and is displayed. The technique was not adequate to show the time course of the gamma efferent activity but some indications of its activity are displayed. Author (TAB)

N66-27622# St. Louis Univ., Mo. School of Medicine.

IMPEDANCE MEASUREMENTS OF CARDIAC OUTPUT DURING MODERATE HEAT EXPOSURE

Bernell Coleman, Alrick B. Hertzman, Louis S. D'Agrosa, and Franz Flath Wright-Patterson AFB, Ohio, AMRL, Feb. 1966 23 p refs

(Contract AF 33(657)-11551)

(AMRL-TR-66-5; AD-631675) CFSTI: HC $3.00/MF $0.50

Cardiac outputs of nude resting subjects were estimated from measurements of the intrathoracic impedance pulses as recorded with the four electrode system. Ambient temperature was increased from 28°C to 43°C. Increases in cardiac output were small, (about 1.0 L/sq.m./min) variable, and due to small increases in heart rate and stroke volume. The greater cardiac output during heat was probably due to the cutaneous vasodilatation as demonstrated in the cutaneous opacity pulses, but this relation was not demonstrated decisively. The ratio of increase in cardiac output to sweating was about the same as that shown previously for cutaneous blood flow and sweating. A decrease occurred in intrathoracic impedance indicating a greater volume of electrolyte fluid in this area. Validation of the thoracic impedance pulses as a measure of right ventricular stroke volume was accomplished in human and canine subjects. Author (TAB)

N66-27623*# Library of Congress, Washington, D. C. Science and Technology Div.

AEROSPACE MEDICINE AND BIOLOGY, AN ANNOTATED BIBLIOGRAPHY. CUMULATIVE INDEXES, 1952–1961 LITERATURE, VOLUME I–X

Roman Kenk and Elaine S. Valliere, ed. 1966 194 p refs

(NASA-CR-75598) CFSTI: HC $5.00/MF $1.25 CSCL 06S

Subject matter, corporate author, and author cumulative indexes are presented in an annotated bibliography on aerospace medicine and biology. Literature published between 1952 and 1961 is indexed in this work which includes all the references published in volumes I through X of *Aerospace Medicine and Biology: An Annotated Bibliography*. M.W.R.

N66-27624*# Library of Congress, Washington, D. C. Science and Technology Div.

AEROSPACE MEDICINE AND BIOLOGY. AN ANNOTATED BIBLIOGRAPHY. 1958–1961 LITERATURE, VOLUMES VII–X, PART 1

Roman Kenk and Elaine S. Vallière, ed. 1966 448 p refs

Sponsored by NASA and AF

(NASA-CR-75599) CFSTI: HC $7.47/MF $2.25 CSCL 06S

Abstracts of aerospace medicine and biology literature for the years between 1958 and 1961 are presented in a reference book which combines the entries that previously appeared in volumes VII through X of *Aerospace Medicine and Biology: An Annotated Bibliography*. These abstracts are presented alphabetically by author under categories within the headings of general aspects, biology, general physiology, neurophysiology and sensory physiology, psychology and psychiatry, and effect of environmental factors and stresses. M.W.R.

N66-27625*# Library of Congress, Washington, D. C. Science and Technology Div.

AEROSPACE MEDICINE AND BIOLOGY. AN ANNOTATED BIBLIOGRAPHY. 1958–1961 LITERATURE, VOLUMES VII–X, PART 2

Roman Kenk and Elaine S. Vallière, ed. 1966 865 p refs

Sponsored by NASA and AF

(NASA-CR-75597) CFSTI: HC $11.64/MF $4.00 CSCL 06S

Abstracts of aerospace medicine and biology literature for the years between 1958 and 1961 are presented in a reference book which combines the entries that previously appeared in volumes VII through X of *Aerospace Medicine and Biology: An Annotated Bibliography*. These abstracts are presented alphabetically by author under categories within the general headings of effects of environmental factors and stresses; personnel; medical problems and pharmacology; toxicology; safety, survival, and rescue; and man–machine integration and life support systems. M.W.R.

N66-27630# School of Aerospace Medicine, Brooks AFB, Tex.
POTASSIUM TRANSPORT MUTANT OF ESCHERICHIA COLI B. ANALYSIS OF POTASSIUM MOVEMENTS Technical Report, Jun. 1964–Dec. 1965
Raymond Damadian Feb. 1966 20 p refs
(SAM-TR-66-19; AD-631205) CFSTI: HC $1.00/MF $0.50

A second mutant of *Escherichia coli* B (strain RD-2) with impaired K transport has been isolated with nitroguanidine as the mutagenic agent. Except for its K requirement, RD-2 manifests the same nutritional requirements as the parent strain and contrasts with RD-1, which was shown to be deficient both in K transport and in methionine biosynthesis (1). RD-2 will not grow in a low K media (20 μM. K) which supports growth of the parent strain. Electron microscopic examination of the two strains reveals no differences in surface layer ultrastructure to account for the transport impairment. Potassium accumulation studies demonstrate that the mutant low K growth failure is attributal to a K accumulation impairment. In contrast to the parent strain, RD-2 cannot accumulate K from the low K media. Addition of K to a nonaccumulating low K suspension of RD-2 stimulates uptake of K, thus establishing viability of the cells. Measurement of low K steady-state tracer fluxes yields flux values for RD-2, which are one-third those of the parent strain, and the calculated influx rate constants are consistent with the interpretation that RD-2's accumulation failure is due to an influx impairment. Author (TAB)

N66-27639# Armed Forces Radiobiology Research Inst., Bethesda, Md.
INCAPACITATION IN THE MONKEY (*MACACA MULATTA*) FOLLOWING EXPOSURE TO A PULSE OF REACTOR RADIATIONS
Leslie J. Seigneur and James T. Brennan Feb. 1966 58 p refs
(AFRRI-SR66-2; AD-631661) CFSTI: HC $3.00/MF $0.75

One hundred and thirty-one monkeys (*Macaca mulatta*) were exposed to scheduled doses of 2,500 through 80,000 rads of pulsed reactor radiations using a triga reactor. The animals were observed with respect to survival time, and time to permanent complete incapacitation. Additional observations of a clinical nature were made during the postirradiation course. An early transient phase of incapacitation lasting from 5 to 30 minutes was noted at dose levels from 2,500 through 30,000 rads. This was followed by a 'plateau' of recovered ability to respond, the duration of the plateau being inversely related to dose. With scheduled doses in the range from 40,000 through 80,000 rads, the plateau phenomenon was suppressed, partial recovery did not usually occur, and the early incapacitation was rapid, progressive, and irreversible. The radiological physics and dosimetry support required for this experiment is reported in detail in AD-631 589.
Author (TAB)

N66-27654# Northrop Space Labs., Hawthorne, Calif. Bioastronautics Lab.
A STUDY OF FLUORESCENT PRODUCTS IN THE URINE OF RATS EXPOSED TO IONIZING RADIATION Formal Progress Report, 1 Nov. 1964–31 Oct. 1965
James A. Demetriou and Frank M. Maciasr Brooks AFB, Tex., School of Aerospace Med., Feb. 1966 20 p refs
(Contract AF 41(609)-2679)
(SAM-TR-66-13; AD-631206) CFSTI: HC $1.00/MF $0.50

The excretion of fluorescent products in the urines of nonirradiated rats and rats exposed to a lethal dose of ionizing radiation was investigated. Fractionation of the urine extracts by gel filtration chromatography yielded eleven fluorescent fractions. Several fractions in the urines of the irradiated animals showed marked decreases in total fluorescence. A new fluorescent fraction was found exclusively in the post-irradiation urines. In addition, other differences between the irradiated and nonirradiated animals were found by means of thin-layer chromatography.
Author (TAB)

N66-27659# Boston Univ., Mass. School of Medicine.
FACTORS AFFECTING SURVIVAL DURING PROLONGED HYPOTHERMIA Final Report, Feb. 1963–Apr. 1965
E. T. Angelakos Wright-Patterson AFB, Ohio. AMRL Dec. 1965 28 p refs
(Contract AF 33(657)-10755)
(AMRL-TR-65-182; AD-631440) CFSTI: HC $2.00/MF $0.50

The mortality of anesthetized dogs maintained under prolonged hypothermia was studied and the factors responsible for death were evaluated. In the technically acceptable experiments, 45% of the dogs maintained at moderate hypothermic temperatures 26°±1°C died within 16 hours. The corresponding mortality in normothermic (38°C) control dogs was 7%. Progressive hemoconcentration and bradycardia were observed during prolonged hypothermia. The former could be abolished by splenectomy. The use of artificial pacemakers to limit the effects of bradycardia was unsuccessful due to the development of other cardiovascular complications. Blood catecholamine levels increased with cooling to 33°C but decreased below control levels at or below 25°C; however, prolonged hypothermia at 25°C was associated with a progressive increase in blood catecholamines up to two to three times the initial control levels. The catecholamine content of aorta, kidney and spleen was not altered significantly by hypothermia, however, cardiac catecholamines decreased to below 50% of control with cooling to 25°C. Adrenergic mechanisms apparently play a key role in the alterations of cardiovascular functions which limit survival during prolonged hypothermia.
Author (TAB)

N66-27660# Armed Forces Radiobiology Research Inst., Bethesda, Md.
EXPERIMENTAL DETERMINATION OF DOSE FOR THE MONKEY IN A REACTOR PULSE ENVIRONMENT
J. H. Dowling Feb. 1966 39 p refs
(AFRRI-SR66-3; AD-631589) CFSTI: HC $2.00/MF $0.50

A study was made of a series of pulse exposures of the monkey using a pulsing TRIGA reactor. The reported doses are based on the kerma calculated from threshold foil data for fast neutrons and the gamma exposure determined by silver activated glass rods. These values were compared with extrapolated (by monitoring sulfur) values determined using tissue equivalent ionization chambers for total dose, a Hurst proportional counter for fast neutron dose, and a graphite–CO_2 ionization chamber and a tetrachloroethylene chemical dosimeter for gamma dose.
Author (TAB)

N66-27677# Southwest Research Inst., San Antonio, Tex. Dept. of Physical and Biological Sciences.
GAS CHROMATOGRAPHIC ANALYSIS OF BODY FLUIDS FOLLOWING MIDLETHAL IRRADIATION Final Report
Arthur L. Grose and George K. Kibler 15 Dec. 1965 14 p
(Contract AF 41(609)-2676)
(AD-631232) CFSTI: HC $1.00/MF $0.50

The program was organized to utilize existing gas chromatographic procedures in current use at the laboratories of Southwest Research Institute for screening a large number of chemical substances to determine what alterations result from radiation exposure. Rats were irradiated, blood or urine was collected from the animals, and gas chromatographic analyses were performed using three different methods. During the last quarterly period of the program, monkeys

were used as the experimental animals. They were irradiated and blood samples periodically taken from the animals were analyzed for amino acids. TAB

N66-27680# Naval Air Development Center, Johnsville, Pa.
SOLID STATE MECHANISMS OF ION TRANSPORT IN BIOLOGICAL SYSTEMS
Freeman W. Cope 31 Dec. 1965 17 p refs
(NADC-MR-6518; AD-631544) CFSTI: HC $1.60/MF $0.50

Leakage of Na^+ across the surface of muscle cells has been observed to obey the Elovich equation, which previously was found to describe various electron transport processes at surfaces of inorganic semiconductors. Analogies between solid state electron transport and liquid or gel state ion transport permit the derivation of the Elovich equation for Na^+ transport across the surface of the muscle cell, but only if it is assumed that muscle Na^+ exists mostly in a complexed form. Direct experimental verification of this theoretical prediction was obtained by nuclear magnetic resonance analysis of muscle Na^+. The similarities between the behavior of ions in cells and electrons in semiconductors suggest the presence of some degree of order of crystallinity in cells, which suggests the applicability to biology of concepts derived from the study of liquid crystals.
Author (TAB)

N66-27701# Oregon State Univ., Corvallis. Radiation Center.
EXPOSURES OF BIOLOGICAL SYSTEMS TO INORGANIC FLUORIDE OXIDIZING AGENTS. VOLUME I: HANDLING AND EXPOSURE TECHNIQUES
Frank N. Dost, Donald J. Reed, and Chih H. Wang Wright-Patterson AFB, Ohio. Aerospace Med. Res. Labs., Dec. 1965 28 p refs
(Contract AF 33(615)-1799)
(AMRL-TR-65-223, Vol. I; AD-631483) CFSTI: HC $2.00/MF $0.50

A system adaptable for diluting and distributing various inorganic fluoride oxidizing agents was developed. Known dilutions of these agents in nitrogen air are generated on the basis of flow rate ratios between undiluted gas and various diluent gases, and confirmed chemically. Problems of materials compatibility, personnel protection, stability of the agents and exposure system design are discussed. Author (TAB)

N66-27754*# Pennsylvania State Univ., University Park. Dept. of Biophysics.
SUPPRESSION OF NONSENSE BY REVERTANT BACTERIA
Stanley Person, Stephen Phillips, Fred Funk, and Mary Osborn [1965] 11 p refs
(Grants NsG-324; NSF GB-4485)
(NASA-CR-75489) CFSTI: HC $1.00/MF $0.50 CSCL 06M

Experiments were performed to test the ability of revertant bacteria of *E. coli* WWU, produced by ultraviolet and ionizing radiations and by uracil-$5H^3$ radioactive decays, to suppress T4 amber B22. The results, which are tabulated, show that the percentage of revertants which can suppress B22 is dependent on the mutagenic agent. For cells irradiated in the liquid state with ionizing radiation, 55% of the revertants formed are su^+. For cells irradiated in the frozen state and in the presence of catalase, the percentage of revertants that can suppress amber B22 is increased to 76 and 74%, respectively. About 83% of the revertants produced by ultraviolet light can suppress B22. The most interesting result is that all revertants produced by uracil-$5H^3$ decay are su^+ for B22. The finding that some arginine revertants of WWU suppress T4 amber mutant whereas the partent WWU does not, indicates that the original mutational alteration preventing the formation of arginine is a nonsense codon and that reversion sometimes occurs by an alteration outside the structural gene. Since the percentage of revertants that can suppress one amber varies according to the mutagenic treatment given, it is concluded that the events leading to reversion with ultraviolet light, ionizing radiation, and uracil-$5H^3$ decay are not identical. R.N.A.

N66-27756*# Beckman Instruments, Inc., Fullerton, Calif. Advanced Technology Operations.
RESEARCH INVESTIGATION OF ELECTRICAL DISCHARGE FRAGMENTATION FOR PROTEIN STRUCTURE IDENTIFICATION Final Report
Irwin Krull and James Sternberg 29 Apr. 1966 28 p refs
(Contract NAS2-3193)
(NASA-CR-75499) CFSTI: HC $2.00/MF $0.50 CSCL 06B

In this study an electrical discharge fragmentation device has been successfully applied to the determination of fragmentation patterns for eleven species of bacteria. Operating parameters studied include the effects of discharge current, discharge gas composition and the choice of chromatographic column on the patterns obtained. Procedures were developed for obtaining highly reproducible retention times. It was found that the greatest differences in patterns for different bacteria occur in fragments which can be lost even under conditions of mild heating (to 250° C) and purging before fragmentation, the instrument and procedure were accordingly modified to prevent this loss, and distinguishable patterns were then obtained for the eleven species of bacteria studied. It has been found that approximately 10 peaks can be labelled as steming from protein substances. Author

N66-27778# Masonic Medical Research Lab., Utica, N. Y.
A STUDY OF THE EFFECTS OF AGE AND IONIZING RADIATION OF NUCLEIC ACID METABOLISM AND PROTEIN SYNTHESIS IN VISCERAL AND CENTRAL NERVOUS SYSTEM TISSUES Technical Progress Report, 15 Mar. 1965–1 Jan. 1966
Verner J. Wulff [1966] 11 p refs
(Contract AT(30-1)-3518)
(TID-22591) CFSTI: HC $1.00/MF $0.50

The metabolism of ribonucleic acid in the liver of young and adult rats was studied after the intraperitoneal injection of ^3H-cytidine one hr prior to killing. The RNA and DNA content of liver nuclei from young and old rats was determined. The turnover of RNA in liver nuclei was measured *in vitro* in diced liver obtained after administration of ^3H-cytidine or ^3H-orotic acid to intact animals. Labeling techniques using ^3H-orotic acid or ^3H-cytidine were developed for use in studies of RNA metabolism in the brain of young and old rats. Preliminary results are included from studies of RNA metabolism in parabiotic rats. NSA

N66-27795# Johns Hopkins Univ., Baltimore, Md. Dept. of Statistics.
RECOMBINATION OF A POOL OF DNA FRAGMENTS WITH COMPLEMENTARY SINGLE-CHAIN ENDS
G. S. Watson, W. K. Smith, and C. A. Thomas Feb. 1966 10 p Submitted for Publication
(Contract Nonr-4010(09); Grants NSF G-10726; NIH GM-1237-02)
(TR-47; AD-631036) CFSTI: HC $1.10/MF $0.50

A model for Gentic Recombination in bacteriophage is presented. The DNA molecules in the pool are broken into fragments randomly, enzymes attack the 3'-ends of the fragments, the exposed bases seek complementary sequences on other fragments and new molecules are reassembled. Formulae are given for the ratio of output to input molecules and for the recombination rate and the length of the genetic map.
Author (TAB)

N66-27796# Naval Radiological Defense Lab., San Francisco, Calif.
RADIATION-INDUCED FREE POLYDEOXYRIBONUCLEOTIDES IN LYMPHOID TISSUES: A PRODUCT OF THE ACTION OF DEOXYRIBONUCLEASE I
Karl F. Swingle and Leonard J. Cole 1 Mar. 1966 24 p refs
(USNRDL-TR-983; AD-631144) CFSTI: HC $2.60/MF $0.50

Physico-chemical studies on the saline-extractable polydeoxyribonucleotides (PDN) occurring in lymphoid tissues 4 hours after whole-body exposure to 600 rads X-irradiation revealed the following information: (1) Viscosity, precipitability by acids and alcohols, and behavior on gel-filtration columns suggest a molecular weight less than that of undegraded DNA but probably greater than 100,000. (2) Thermal transition curves indicate extensive complementary double stranding with slight 'fraying' of the ends of the strands. (3) In 0.2 M NaCl, PDN has a lower affinity for histone than does DNA. (4) Susceptibility of PDN to the action of venom phosphodiesterase (EC 3.1.4.1) and resistance to spleen phosphodiesterase (EC 3.1.4.1) demonstrate the presence of 3'-hydroxyl terminals and the absence of 5'-hydroxyl terminals. (5) The above observations suggest that PDN was formed from DNA by the action of a deoxyribonuclease I-like (EC 3.1.4.5) endonuclease rather than a deoxyribonuclease II-like (EC 3.1.5.6) endonuclease in the irradiated tissue. Author (TAB)

N66-27812# Naval Radiological Defense Lab., San Francisco, Calif.
THE DNA CONTENT OF MITOTIC NUCLEI OF TWO MOUSE TUMORS
Edward L. Alpen and Muriel E. Johnston 3 Mar. 1966 18 p refs
(USNRDL-TR-986; AD-631145) CFSTI: HC $1.60/MF $0.50

A new high-precision microspectrophotometric method was used to test the validity of the 'DNA constancy hypothesis' in two mammalian tumor lines. The two are the mouse ascitic tumor BP-8 and the in vitro mouse leukemic cell line, L5178Y. It was shown that the mitotic nuclei of these cells have a DNA content with a coefficient of variation of 5–6%. The instrumental and measurement errors are 4–5%; thus the variability of DNA content as measured by absorption of Feulgen stain is 1% or less. Author (TAB)

N66-27817# Martin Co., Baltimore, Md. Research Inst. for Advanced Studies.
BASIC RESEARCH IN PHOTOSYNTHESIS Final Report, 1 Oct. 1960–31 Dec. 1965
Bessel Kok [1966] 9 p refs
(Contract AT 49(638)-947)
(AFOSR-66-0602; AD-630524) CFSTI: HC $1.10/MF $0.50

Instrumentation and methodology were developed in the areas of mass spectrometry, sensitive spectroscopy, polarography (oxygen exchange), and techniques for irradiating photosynthetic materials with high intensity monochromatic light. Oxygen uptake could be decreased on wavelength of illumination. Photosystem I was sensitized predominantly by long-wave illumination, with suppression of respiratory uptake. Photosystem II, with inducement of increased oxygen uptake by shortwave illumination, was not explained fully. A longwave chlorophyll component (P700) was detected in the chloroplast which occurs in the low concentration of 1 per 100 total chlorophylls. In the primary event of photosystem I, P700, upon excitation must lose an electron to an associated reaction partner. In complete photosynthesis, the P700 is re-reduced by photosystem II. In a study with a mutant of Scenedesmus, the reducing power generated in photosystem II, simultaneous with oxygen, was not lower than +0.18 volts. TAB

N66-27822# Naval Civil Engineering Lab., Port Hueneme, Calif.
DEEP-OCEAN BIODETERIORATION OF MATERIALS. PART III: THREE YEARS AT 5,300 FEET Technical Report, Mar. 1962–Jun. 1965
James S. Mursoka Feb. 1966 53 p refs
(R-428; AD-631078) CFSTI: HC $3.00/MF $0.50

The report covers data obtained after exposing 1,318 test specimens of 318 different materials for 35 months on the Pacific Ocean floor at a depth of 5,300 feet. The materials were attached to a Submersible Test Unit (STU). The STU was retrieved in February 1965 and returned to the Laboratory for tests and analyses. Hydroid growths were found on all the test specimens placed on the STU. A few species of tube worms were found attached to metals, plastics, and coated test specimens. Most of the plastics and all the rope materials were covered with bacterial slime growth. Cotton and Manila rope specimens were severely deteriorated by bacterial action. Wood panels, plastics, and Manila ropes were attacked by marine borers. Metals, natural and butyl rubber, and certain plastic materials were not affected. Author (TAB)

N66-27860# Miami Valley Hospital, Dayton, Ohio. Dept. of Research.
THE METABOLIC ACTIVITY OF INTACT CELL DISPERSATES FROM NORMAL AND OXYGEN INTOXICATED RATS Final Report, 1 Feb. 1963–30 Jun. 1964
Bernard J. Katchman, Marcia L. Collins, and George M. Horner Wright-Patterson AFB, Ohio, AMRL Dec. 1965 56 p refs
(Contract AF 33(657)-9843)
(AMRL-TR-65-173; AD-630694) CFSTI: HC $3.00/MF $0.50

Methodology for the preparation of intact tissue dispersates was investigated. The metabolic behavior of liver cell dispersates was examined and an assay system suitable to evaluate metabolic activity effected. Metabolic alterations induced in animals exposed to 98–99% O_2 at 1/3 and at 1 atmosphere have been investigated. Intact liver cell dispersates derived from rats exposed to O_2 environments (1 atmosphere) for periods up to death show 40% greater respiratory activity than control rats. In addition, the livers from these O_2 intoxicated animals showed decreased mass, decreased cell size, and an increase in total nitrogen. These effects were not time dependent. The only effect noted in animals exposed at 1/3 atmosphere of 98–99% O_2 was a decrease in liver mass. The significance of these results in O_2 intoxication is discussed. Author (TAB)

N66-27862# Geoscience, Ltd., La Jolla, Calif.
THERMAL AND ELECTRICAL CONDUCTIVITIES OF BIOLOGICAL FLUIDS AND TISSUES Annual Report, 1 Apr. 1965–31 Mar. 1966
Heinz F. Poppendiek, Norman D. Greene, W. A. Morton, P. M. Morehouse, R. Randall et al 31 Mar. 1966 43 p refs
(Contract Nonr-4095(00))
(GLR-43; AD-630712) CFSTI: HC $2.00/MF $0.50

The objective of the research program has been the experimental and analytical determination and correlation of thermal and electrical conductivities of biological fluids and tissues both under normal and stressed conditions. The stressing consists of freeze-thaw processes at slow and rapid rates. A second objective of the program has been to establish the relations between changes in these physical properties of biological specimens and the physical stresses imposed upon them. Author (TAB)

N66-27867# Naval Medical Field Research Lab., Camp Le Jeune, N. C.

IMPROVEMENTS IN RECORDING HEART RATE DURING EXERCISE IN THE PERSPIRING SUBJECT

W. G. Holcomb (Airborne Instr. Labs.) Feb. 1966 21 p refs /ts Interim Rept., Vol. XVI, No. 4

(MF022.03.04-8002.4; AD-631142) CFSTI: HC $2.60/MF $0.50

Electrodes manufactured by Naval Medical Field Research Laboratory (NMFRL) were compared with those manufactured by Beckman Instruments Company for the purpose of obtaining heart rates during vigorous activity (treadmill walking) under conditions of high temperature and humidity. Also, use of the Ace (R) bandage to secure the electrodes in place was compared with use of the Beckman adhesive fastener. The electrodes manufactured by NMFRL performed as well as did those manufactured by Beckman Instruments. The adhesive fastener presented advantages over the Ace (R) bandage, but a longitudinal study is required to determine whether its use over a period of time will result in dermatologic problems. The analog presentation of heart rate data presented several advantages over previous techniques. Author (TAB)

N66-27905# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A METHOD FOR THE SIMULTANEOUS REGISTRATION OF SOME INDICES OF THE ACTIVITY OF THE SALIVARY GLAND

N. Y. Vakolyuk 21 Jan. 1966 7 p Transl. into ENGLISH from Fiziol. Zh. SSSR (Moscow), v. 9, no. 6, 1963 p 829-830

(FTD-TT-65-1520/1+2+4; AD-630993) CFSTI: HC $1.10/MF $0.50

A hermetically sealed system, with an internal thermocouple, for the electrographic registration and measurement of saliva droplets is described. The parameters of principle interest are temperature oscillations and bioelectric potentials. A tube fastened to the inside of the cheek conducts the saliva into the system, wherein the registration and measurements are performed. D.T.

N66-27954*# Naval School of Aviation Medicine, Pensacola, Fla.

THOUSAND AVIATOR STUDY: NONVESTIBULAR CONTRIBUTIONS TO POSTURAL EQUILIBRIUM FUNCTIONS

Alfred R. Fregly, Albert Oberman, Ashton Graybiel, and Robert E. Mitchell 17 Mar. 1966 19 p refs

(NASA Order R-136)

(NASA-CR-75520; NAMI-958) CFSTI: HC $1.00/MF $0.50 CSCL 06N

In a preliminary study of nonvestibular sources of variance in the postural equilibrium functioning of a group of middle-aged males, twent-eight of thirty-eight selected measures have been shown to be related to one or another of three postural criteria. Outstanding among these, in descending order of magnitude, are: abdominal circumference, age, endomorphy, heart rate immediately after exercise, and duration of cigarette smoking. These and other findings are discussed in terms of their implications for vestibular and gerontological research. Author

N66-27966# Joint Publications Research Service, Washington, D. C.

PHYSIOLOGICAL PRINCIPLES OF CONDITIONING OF A HUMAN ORGANISM

M. Ye. Marshak 6 Jun. 1966 151 p refs Transl. into ENGLISH of the book "Fiziologicheskiye Osnovy Zakalivaniya Organizma Cheloveka" Leningrad, Meditsina Publishing House, 1965 2d ed. p 1-151

(JPRS-35864; TT-66-32298) CFSTI: $4.00

Consideration is given to physiological changes which occur in the human organism as a result of adaptation to various cold, heat, altitude, and atmospheric pressure conditions. Summaries are presented of various experiments which indicate the ability of the organism to develop increased resistance to environmental factors different from the usual norms. Chapters of the text deal with the effects of exposure to local and generalized cooling of long periods, and the increase in resistance to cold exhibited by patients with pulmonary tuberculosis. Repeated exposure to high external temperatures, reduced atmospheric pressures, and high altitudes are considered. Hypoxic phenomena during muscular work and the effect of hypocapnia in hypoxia are also discussed. Certain rules are developed which are considered to govern the adaptation of the organism to adverse conditions, and the principles for creating an adaptation regime are discussed. M.W.R.

N66-28007*# National Aeronautics and Space Administration, Washington, D. C.

AEROSPACE MEDICINE AND BIOLOGY—A CONTINUING BIBLIOGRAPHY, APRIL 1966

May 1966 168 p refs

(NASA-SP-7011(24)) CFSTI: HC $1.00/MF $1.00 CSCL 06S

An annotated bibliography on aerospace medicine and biology is presented along with subject, corporate source, and personal author indices. Included are references on the biological, physiological, psychological, and exvironmental effects to which man is subjected during the following simulated or actual flight in the earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. R.N.A.

N66-28131# Argentina. Comision Nacional de Energia Atomica, Buenos Aires.

STUDY OF THE METABOLISM OF THE OXYGEN COMPOUNDS OF IODINE: IODATE AND PERIODATE (I-131) [ESTUDIO DEL METABOLISMO DE LAS OXIBALES DE IODO: IODATO Y PERIODATO (I-131)]

L. J. Anghileri 1965 14 p refs In SPANISH

(CNEA-164) CFSTI: HC $1.00/MF $0.50

This study was performed on the metabolism of iodate and periodate labelled with iodine-131. Rats were injected with the radioiodates, sacrificed at various intervals, and the activity of their organs and tissues determined by means

of a scintillation counter. The organs were then homogenized, centrifuged, and chromatographically analyzed. In other rats, the whole body activity was measured to determine the elimination rate of the radioactive injection. Values of the specific activity and the percentages of injected activity present at various times in the different organs and tissues for both iodates are tabulated and discussed. The results give an index of the elimination mechanism of the iodates. Except for the localized reduction mechanism in the liver, the elimination corresponds to that of iodine which is almost fully accomplished at the level of the gastric mucous. The low percentages observed in the various organs can be considered as the result of the small amount of radioiodate injected, its rapid elimination, and the general distribution of the iodates throughout the organism. Transl. by R.N.A.

N66-28156# National Research Council of Canada, Ottawa (Ontario). Low Temperature Section.
A BIOLOGICAL HEAT EXCHANGER FOR BRAIN COOLING
T. R. Ringer and E. W. Peterson Apr. 1966 22 p refs
(DME-Misc.-38) CFSTI: HC $1.00/MF $0.50

Consequent to the fact that the metabolic rate of brain tissue is proportional to its temperature, and additionally, that the central nervous system can withstand much lower temperatures than the heart, a system for the selective cooling of the brain was designed. A stainless steel helical heat exchanger, based upon this design, was developed, and then tested over a two year period. Using the exchanger in experimental brain surgery, temperatures of 5°C were obtained, with the blood supply to the brain subsequently occluded for periods of one hour with recovery. D.T.

N66-28160# Royal Air Force, Farnborough (England). Inst. of Aviation Medicine.
THERMAL RADIATION IN THE INVESTIGATION OF CUTANEOUS VASOMOTOR AND SUDOMOTOR CONTROL
D. Mc K. Kerslake Sep. 1964 25 p refs
(FPRC/1226) CFSTI: HC $1.00/MF $0.50

The use of thermal radiation as a stimulus in the study of thermoregulatory responses is reviewed. It has proved of particular value in the investigation of reflexes depending on cutaneous afferent systems. Some conclusions are drawn about the nature of the sensitivity of the cutaneous receptors concerned, and the nervous pathways involved. Author

N66-28165# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
ATTEMPTS AT BIOPHYSICAL SCHEMATIZATION [TENTATIVI DI SCHEMATIZZAZIONE BIOFISICA]
M. Ageno 10 Mar. 1966 31 p In ITALIAN; ENGLISH summary
(ISS-66/10) CFSTI: HC $2.00/MF $0.50

In efforts toward biophysical schematizations the following are discussed: (1) the importance of the electron microscope for biological research; (2) cell division and reproduction, biological functions of cells, and isolated cells; and (3) molecular formations, interactions, structures, and groups, transport phenomena, and macromolecules. Also mentioned are single and multi-cell organisms, amino acids, ribonucleic acid, tissue, and resonance exchange. Transl. by D.T.

N66-28168# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).
POSSIBLE RADIOACTIVE CONTAMINATION OF MAN AND HIS ENVIRONMENT BY THE USE OF NUCLEAR POWER IN SPACE [MOGELIJKE RADIOACTIEVE BESMETTING VAN DE MENS EN ZIJN OMGEVING DOOR HET GEBRUIK VAN KERN-ENERGIE IN DE RUIMTEVAART]
J. F. Bleichrodt and Johannes Blok Jan. 1966 32 p refs In DUTCH; ENGLISH summary
(MBL-1966-1; TDCK-45102) CFSTI: HC $2.00/MF $0.50

This paper reviews the possibilities of radioactive contamination of man and his environment by the use of nuclear power in space vehicles. Methods for the estimation of radiation dose after burn-up of satellites during reentry into the atmosphere are given. After complete burn-up of a thermoelectric generator fueled with ^{90}Sr, ^{137}Cs or ^{238}Pu the radioactive material will be spread in the atmosphere and gradually reach the surface of the earth giving rise to irradiation of gonads, bone and bone marrow of the world population. The order of magnitude of the radiation dose these organs are exposed to is estimated at 1 mrad per kW of thermal power of the generator. Burn-up of a nuclear reactor after operation during one year at a power level of 10 MW will result in doses of 0.04, 0.33 and 0.11 mrad in gonads, bone and bone marrow respectively. Calculations were based on the assumption that the radioactive particles are soluble in body fluids. Insoluble particles may result in an inhomogeneous dose distribution in the lungs. It is not certain therefore that the calculated doses are the only criteria needed to appreciate the risks involved. Author

N66-28168# Argentina. Comision Nacional de Energia Atomica, Buenos Aires.
DISTRIBUTION OF COLLOIDAL CHROMIC PHOSPHATE (P-32) IN RATS INFLUENCED BY THE SIZE OF THE PARTICLES [LA DISTRIBUCION DEL FOSFATO CROMICO COLOIDAL (P-32) EN RATONES INFLUENCIA DEL TAMANO DE LAS PARTICULAS]
L. J. Anghileri 1965 29 p refs In SPANISH
(CNEA-158) CFSTI: HC $2.00/MF $0.50

A study was conducted to determine the effect of particle size on the distribution of chromic phosphate colloid solutions in rats after injections by three means, intravenous, intramuscular, and intracavity. The salient characteristics of the distinct types of colloids studied are described with respect to their fixation or retention by the various organs and tissues. In general, the colloid characteristics are similar with respect to their in vivo distribution which is largely conditioned by the size of the particles and by the means of injection. The distribution of the colloid particles is complex and various factors can alter the general scheme. The principal organ that captures the colloid is the liver and its activity decreases the size of the colloid particles. Based on the difference in the structure of the types of colloidal chromic phosphate, the distribution in the organism is affected in the case of the various colloids studied, at the posterior duration in vivo of the complex chrom-gelatin phosphate. This supposition explains the alternate observations in their distribution and elimination not already affected by particle size. Transl. by R.N.A.

N66-28179# Brussels Univ. (Belgium).
NUCLEAR MEDICINE [MEDECINE NUCLEAIRE] Annual Report, 1964

Brussels, EURATOM, 1966 68 p refs In FRENCH and ITALIAN; ENGLISH summary Prepared jointly with Pisa Univ. (Contract EURATOM-026-63-4 BIAC)
(EUR-2636.f,i) CFSTI: HC $3.00/MF $0.75

Theoretical and experimental studies are reported in a large number of fields related to nuclear medicine. Blood changes, tumor development, and circulatory and metabolic disorders caused by radiation are discussed. Cerebral blood-flow rate measurements following exposure to krypton 85, a dynamic model for iodine metabolism, and behavior of kidneys after iodine 131 exposure are investigated. Measurement is made of intestinal absorption of the triglycerides, albumin, and xylose; and determination is made of neutron activation of ionic composition in children. M.W.R.

N66-28203# Flying Personnel Research Committee, London (England).

THE EFFECT OF POSITIVE ACCELERATION ON THE INEQUALITY OF VENTILATION AND PERFUSION IN THE LUNG

D. H. Glaister (RAF Inst. of Aviation Med.) Sep. 1964 29 p refs
(FPRC/1231) CFSTI: HC $2.00/MF $0.50

The distribution of ventilation and blood flow in the human lung has been studied by means of continuous analysis of expired air for CO_2 and, following a single breath of pure O_2 for N_2. At rest, the concentrations of CO_2 and N_2 both rose slowly and steadily throughout the expiration. During positive acceleration at 1.4–3.0 'g', the N_2 concentration rose more steeply, but CO_2 was either unaffected or its concentration fell towards the end of the expiration. At 3.0 'g', up to one third of the total ventilated lung volume was shown to be unperfused. This region is probably the upper lung where the gravitational reduction in blood flow will be most marked. The sudden production of an inequality in the distribution of ventilation and perfusion, as by acceleration, results in a temporary decrease in pulmonary gas exchange and in a lasting reduction in the O_2 saturation of arterial blood. The mechanism by which positive acceleration could produce changes in the distribution of ventilation and perfusion is discussed, together with the significance of these changes in relation to the lung collapse which may occur when O_2 is breathed during acceleration. Author

N66-28214# Instituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.

RESEARCHES ON THE ETIOLOGICAL AGENT OF VIRAL HEPATITIS AND OF THE CHANGES IN THE FINE STRUCTURE OF THE HEPATIC CELLS WHICH TAKE PLACE DURING THE INFECTION [PRESENZA DI ELEMENTI VIRUS-SIMILI NELLE CELLULE EPATICHE DI PAZIENTI AFFETTI DA EPATITE VIRALE]

B. Babudieri, E. Fiaschi, R. Naccarato, G. Papa, and L. A. Scuro (Padua Univ.) 5 Oct. 1965 24 p refs
(ISS-65/38) CFSTI: HC $2.00/MF $0.50

Characteristic of the liver cell during the course of viral hepatitis is the large number of ribosomes, which either form clusters or are arranged in more parallel lines, with regular intervals between the granules. In ten patients the cytoplasm "saccula," surrounded by a monolayer membrane and containing round virus-like particles, with a diameter of about 200 Å was observed. These saccula correspond in size and appearance to fluorescent areas observed after treatment of human infected liver cells with gamma globulins, from convalescents from viral hepatitis, conjugated with fluorescein isothiocyanate. In liver sections treated with ferritin-labelled specific gamma globulins, some clumps of ferritin granules were observed, probably surrounding the virus-like bodies. The authors believe that these bodies could correspond to the agent of human viral hepatitis. Author

N66-28219# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf (Austria).

THE DETERMINATION OF IODINE IN TOTAL SERUM AND IN ALBUMIN SERUM WITH NEUTRON ACTIVATION ANALYSIS [ZUR BESTIMMUNG VON JOD IM GESAMTSERUM UND IM SERUMEIWEISS MIT DER NEUTRONENAKTIVIERUNGS-ANALYSE]

H. Frischauf and H. Altmann 1966 10 p refs In GERMAN Presented at 7th Intern. Symp. on Radioactive Isotopes in Medicine and Research, Bad Gastein, Austria Submitted for Publication
(SGAE-BL-18/1966) CFSTI: HC $1.00/MF $0.50

Iodine was separated from the serum and from the albumin precipitation of the serum by burning in oxygen. A platinum basket held the sample and served as catalyst. The free iodine was transferred to a benzene phase, which was washed with a NaCl-containing water solution. Activation was measured with a gamma spectrometer and was followed by chemical analysis. The method was found to be simple, fast, and suitable for iodine determination in biological material or tissue. Transl. by K.W.

N66-28228# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.

LIPID GLOBULES IN OSTEOGENIC CELLS. A HISTOCHEMICAL AND ELECTRON-MICROSCOPIC INVESTIGATION

E. Bonucci (Pisa Univ.) 5 Oct. 1965 25 p refs Sponsored by the Consiglio Nazl. Delle Ric.
(ISS-65/36) CFSTI: HC $1.00/MF $0.50

A histochemical and electron microscopic study of cells involved in membranous ossification (with special reference to lipid globules) is presented. The results suggest that the acquisition of a high rate of synthesizing activity may be connected with glycogen and lipid depletion. The significance of this is discussed. Author

N66-28240# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.

ELECTRON MICROSCOPE STUDY OF *CHRONDROSTAGON HAEMATICUM*

B. Babudieri and F. Tangucci 5 Oct. 1965 20 p ref Sponsored by the Consiglio Nazl. Delle Ric.
(ISS-65/39) CFSTI: HC $1.00/MF $0.50

The fine morphology of a parasite of the red blood cells of *Hydromantes italicus* has been studied in the electron microscope. This parasite, named *Chondrostagon haematicum*, has the particular morphological characteristics of the *Mycoplasmata*. Author

N66-28330# European Atomic Energy Community, Brussels (Belgium). Radiobiology.

ACUTE AND CHRONIC EFFECTS OF RADIATIONS CONSIDERED PRIMARILY FROM THE ANGLE OF NUCLEIC ACID AND PROTEIN Final Report [EFFETS AIGUS ET CHRONIQUES DES RADIATIONS ENVISAGEES SURTOUT AU POINT DE VUE DU METABOLISME DES ACIDES NUCLEIQUES ET DES PROTEINES Rapport Final]

Apr. 1966 42 p refs In FRENCH and GERMAN; ENGLISH summary
(Contract EURATOM-053-64-3 BIOB)
(EUR-2769.f) CFSTI: HC $2.00/MF $0.50

Studies are reported on the early cytochemical, biochemical, and genetic effects of ionizing radiations on plants and mammalian tissues, and on their modifications by radioprotectors. The following projects were included: (1) Studies on the effects of radiations on : the ultrastructure of the duodenum, the influence of the age on the radiosensitivity of rats, the incidence of dominant lethals in male germ cells, chromosomal lesions, several biochemical alterations, especially the metabolism of proteins, of thymidine kinase, of nuclear RNA, of acid DNAse of the spleen, of DNA synthesis in the perfused liver, of tryptophane, etc. (2) Studies on the mechanisms of action of radioprotectors: the increased effectiveness of mixtures of radioprotectors; the study of the influence of radioprotectors on cell metabolism. (3) Studies on the influence of radiation on the permeability of the cell membrane to DNA and on the translocation of DNA in different organisms (mice and plants), by means of chromatographic studies with DEAE-cellulose paper, ultracentrifugational studies in CsCl gradients and autoradiographic studies. Author

N66-28341# Argentina. Comision Nacional de Energia Atomica, Buenos Aires.
A NEW Tc^{99m} COLLOID IN HEPATIC SCINTILLATION SCANNING [UN NUEVO COLOIDE DE Tc^{99m} EN CENTELLOGRAFIA HEPATICA]
Jose Martinez Seeber, Victorio Pecorini, Osvaldo Degrossi, Americo Olivari, and Abraham Chwojnik 1966 12 p refs In SPANISH
(CNEA-168) CFSTI: HC $1.00/MF $0.50

This paper describes the experience gained in hepatic scintillagraphy using a new sulfur-antimony colloid labeled with Tc^{99m}. The nuclide emits pure low energy gamma radiation. The colloid is captured by the reticuloendothelial system, concentrating the radioactive nuclide in the liver. These two advantages explain the excellent results obtained in the hepatic scintillagraphy with this compound. Because of its short half-life and radioactive emission characteristics, the dose of body and target organ (liver) radiation is substantially lower when the Tc^{99m} labeled colloid is compared with other labeled compounds also used in hepatic scintillagraphy. Transl. by R.N.A.

N66-28344# Royal Inst. of Tech., Stockholm (Sweden). Speech Transmission Lab.
SPEECH TRANSMISSION LABORATORY Quarterly Progress Summary and Status Report No. 23, 15 Apr. 1966
15 Apr. 1966 66 p refs
(Contract DA-91-591-EUC-3881; Grants AF-EOAR-66-24; NIH NB-04003-04)
(STL-QPSR-1/1966) CFSTI: HC $3.00/MF $0.75

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1. SPEECH PRODUCTION S. Ohman et al p 1–16 refs
2. SPEECH PERCEPTION J. Martony et al p 17–22 refs
3. INSTRUMENTATION FOR ANALYSIS AND SYNTHESIS J. Liljencrants et al p 23–36 refs

N66-28348# California Univ., Los Angeles.
LABORATORY OF NUCLEAR MEDICINE AND RADIATION BIOLOGY SEMIANNUAL PROGRESS REPORT, PERIOD ENDING 31 DECEMBER 1965
[1965] 106 p refs
(Contract AT(04-1)GEN-12)
(UCLA-12-576) CFSTI: HC $4.00/MF $0.75

Summaries of research efforts in the major areas of biochemistry, radiobiology, pharmacology and toxicology, nuclear medicine, biophysics, and environmental radiation are compiled. These include such investigations as the effect of lipids on enzyme level in beating rat heart cells; the effect of chloride ions on some radiation chemical reactions; lung scanning radioaerosol inhalation; arteriolar blockade studies; irradiation of Neurospora crassa; gamma spectrometry of neutron activated soils; and effects of beryllium in plants and soil. C.T.C.

N66-28355# Los Alamos Scientific Lab., N. Mex.
BIOLOGICAL AND MEDICAL RESEARCH GROUP (H-4) OF THE HEALTH DIVISION Annual Report, Jul. 1964–Jun. 1965
20 Dec. 1965 267 p refs
(Contract W-7405-ENG-36)
(LA-3432-MS) CFSTI: HC $8.00/MF $1.50

A compilation of summaries of research efforts in biological and medical programs involving fundamental and applied investigations is presented. The fundamental studies were directed toward the biological phenomena at the molecular and cellular levels; while the applied investigations were concerned largely with somatic and genetic effects of radiation on animals. Major topics include mammalian metabolism, mammalian radiobiology, biophysics, cellular radiobiology, and molecular radiobiology. C.T.C.

N66-28367*# National Aeronautics and Space Administration, Washington, D. C.
THE INFLUENCE OF LOW TEMPERATURE ON MICROORGANISMS. PART II. THE INFLUENCE OF LOW TEMPERATURE ON THE DEVELOPMENT OF MOLDS [VLIYANIYE NIZKIKH TEMPERATUR NA MIKROORGANIZMY. II: VLIYANIYE NIZKIKH TEMPERATUR NA RAZVITIYE PLESNEVYKH GRIBKOV]
F. M. Chistyakov and Z. Z. Bocharova May 1966 33 p refs Transl. into ENGLISH from Mikrobiologiya (Moscow), v. 6, no. 9–10, 1937 p 1293–1309
(NASA-TT-F-10144) CFSTI: HC $2.00/MF $0.50 CSCL 06M

The effect of low temperatures on the growth of molds, with emphasis on food storage problems, is discussed. Experiments on 40 different species of molds, some of which were isolated from frozen foods, showed viability and growth at temperatures as low as −8°C. The effect of low temperatures on visible growth and formation of conidia or spores differs for the various species and strains. The delay in the appearance of visible growth lengthens with decreasing temperature, reaching its maximum in the interval before the temperature minimum at which growth stops completely. Author

05 BIOTECHNOLOGY

Includes life support systems; human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N66-27218# Institute for Research, State College, Pa.
PURPOSIVE SYSTEMS THEORY AND APPLICATION Final Report, 1 Apr. 1963–30 Jun. 1964
H. Edward Massengill, Jr. Bedford, Mass., AFSC, Electron Systems Div., Jul. 1964 48 p refs
(Contract AF 19(628)-2968)
(ESD-TDR-64-531; AD-609377) CFSTI: HC $3.00/MF $0.75

The purpose of this paper is to summarize the approach and theory on which the research performed is based. Basically, the approach is the use of decision theory, with the assumption that people behave optimally given their formulations and constraints, to study the significant tasks that people perform. The ultimate goal of the approach is to map human behavior onto logic and mathematics. The emergence of the approach is given along with four basic requirements that we make of any theory to be used in understanding the behavior of individuals. The approach is contrasted with more traditional approaches. The procedure of the approach, task analysis, is explained and is illustrated by examples from the contract research. The place of applications in the approach is dealt with extensively. The paper includes a guide to the more important ideas dealt with in the contract research with references to the relevant contract publications. Abstracts of these publications, seven completed and seven in preparation, are also included.
Author (TAB)

N66-27228*# General Dynamics/Convair, San Diego, Calif.
LIFE SUPPORT SYSTEM FOR SPACE FLIGHTS OF EXTENDED TIME PERIODS: LIQUID/GAS SEPARATION MECHANISMS
S. Mc Cunney and J. Burnett 13 Sep. 1965 37 p refs *Its* Rept.-64-26231
(Contract NAS1-2934)
(NASA-CR-66060) CFSTI: HC $2.00/MF $0.50 CSCL 06K

This report presents a summary of the experiences dealing directly with the several liquid/gas separation mechanisms employed in applications specifically involved with air–water separation. The report summarizes requirements, describes types of mechanisms employed, outlines developmental problems and solutions attempted, briefly discusses current performance of the various units, and recommends actions for continued development as required.
Author

N66-27235*# Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.
BIOENERGETICS OF SPACE SUITS FOR LUNAR EXPLORATION Literature Review
Emanuel M. Roth Washington, NASA 1966 145 p refs
(Contract NASr-115)
(NASA-SP-84) GPO: HC $1.00; CFSTI: MF $1.00 CSCL 06B

This report reviews environmental information currently available from astrophysical studies, and analyzes the metabolic load imposed on humans exercising under varied terrain and gravity conditions, the metabolic cost of mobility restriction in space suits, and the problem of thermal control in lunar space suits.
Author

N66-27236*# Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.
PHILOSPHY OF SIMULATION IN A MAN-MACHINE SPACE MISSION SYSTEM
T. M. Fraser Washington, NASA 1966 116 p refs
(Contract NASr-115)
(NASA-SP-102) GPO: HC $0.50; CFSTI: MF $0.75 CSCL 05H

This report examines the philosophy of simulation as it pertains to manned space activities, with a particular orientation to research in the life sciences. Included are discussions on the nature of simulation; prerequisites for simulation; the fidelity, realism, and transfer of training; and the use of manned simulators.
R.N.A.

N66-27295# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Aero Propulsion Lab.
ASTRONAUT MANEUVERING UNIT TECHNOLOGY
Peter N. Van Schaik *In its* Aerospace Expandable Struct. [1966] p 633–648 refs (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

The modular maneuvering unit, the astronaut maneuvering unit, and the remote maneuvering unit are discussed. The current systems, and the design criteria and new subsystems are reviewed. The problem areas, such as plume heating, stabilization, and system redundancy, are described. The present technology is reported, and future areas of development are indicated.
N.E.N.

N66-27436# Air Force Systems Command, Wright-Patterson AFB, Ohio. Aero Propulsion Lab.
MAINTENANCE IN A WEIGHTLESS ENVIRONMENT
Chester B. May 1965 60 p refs
(AD-630807) CFSTI: HC $3.00/MF $0.75

Design criteria evolved through tests in simulated zero-g environments enabled the development of techniques, equipment, and tools for space maintenance and the study of man's work ability under weightless conditions. Evaluations of the test data are encouraging in the prediction of a practical space maintenance capability. However, because of the combined effects of extended time in space, the spacecraft performance in flight, and the space environment, conclusions based on laboratory tests must be verified by experimentation on test beds designed for extended space operations. Refinements to the prototype techniques, equipment, and tools are certainly anticipated after the evaluation of these in-space tests.
TAB

N66-27442# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPARATUS FOR AUTOMATIC RECORDING OF THE ARTERIAL BLOOD PRESSURE
L. A. Kazar'yan and V. V. Lepeshkin 21 Jan. 1966 7 p Transl. into ENGLISH from Soviet patent no. 166098 (Appl. no. 857493/31-16, 19 Sep. 1963) 3 p
(FTD-TT-65-1579/1+2+4; AD-630994) CFSTI: HC $1.10/MF $0.50

An apparatus for the automatical recording of the arterial blood pressure is described. It consists of a pressure cuff which fastens to the shoulder of the test subject, a balloon with compressed air, and a miniature source of electric power supply. An automatic pressure device in the form of a spasmodic pneumatic switch is set in motion by means of a miniature sylphon with an electric contact in the transmitter circuit, accomplishing a periodic variation of air pressure in the pneumatic system for compressing the blood vessels. The apparatus is different in that the recording of the pulse oscillations is accomplished by means of a thermoanomometer transmitter, the output of which is switched onto a recording oscillograph.
TAB

N66-27533*# Stanford Univ., Calif.
PREDICTOR AIDED TRACKING IN A SYSTEM WITH TIME DELAY: PERFORMANCE INVOLVING FLAT SURFACE, ROLL, AND PITCH CONDITIONS
John M. Leslie, Lawrence A. Bennigson, and Michael E. Kahn Mar. 1966 51 p refs
(Grant NsG-111-61)
(NASA-CR-75399) CFSTI: HC $3.00/MF $0.50 CSCL 05H

This report describes a study of a human operator's ability to pursuit track a course under conditions where his control commands are delayed 2.6 seconds. The purpose was to prove the effectiveness of a predictor as an aiding device to an operator who has the task of driving a vehicle through such a transmission delay. Thirty subjects were tested under combinations of four speeds (2,3,4,5 mph), four terrain conditions (flat, roll, pitch, roll and pitch), and three control modes (no-delay, delay without predictor, delay with predictor). Tracking performance with the predictor proved to be an improvement over performance without predictor to a confidence level of at least 99% for all conditions tested. Author

N66-27558# Laboratoires du Centre d'Etude de l'Energie Nucleaire, Mol (Belgium).
WORKING CONDITIONS AND SAFETY IN LABORATORIES OF THE DEPARTMENT OF RADIOISOTOPES AT MOL [CONDITIONS DE TRAVAIL ET DE SECURITE DANS LES LABORATOIRES DU DEPARTMENT DES RADIOISOTOPES A MOL]
R. Constant and J. Mekers Mar. 1965 17 p refs In FRENCH
(BLG-68-11)

The new installations for the production and distribution of radioisotopes at Mol are described. Author (NSA)

N66-27564# Brookhaven National Lab., Upton, N. Y. Health Physics Div.
CALIBRATION AND RESPONSE OF PERSONNEL MONITORING FILM DOSIMETERS TO SYNCHROTRON STRAY RADIATIONS
Leigh F. Phillips and Robert J. Champagne [1965] 10 p refs Presented at 1st Symp. on Accelerator Radiation Dosimetry and Experience, Upton, N. Y.
(Contract AT(30-2)-GEN-16)
(BNL-9665; CONF-651109-7) CFSTI: HC $1.00/MF $0.50

In order to determine effectiveness of personnel monitoring techniques at high energy proton synchrotrons, a careful evaluation of the film badge performance was made. These evaluation studies were performed in various work areas and under a variety of experimental conditions because the synchrotron parameters, such as shielding and experimental arrangements, vary greatly, thus radically changing the quality and quantity of the stray radiation fields. Among the dosimeters employed for this study were the BNL film badge and specially designed tissue-equivalent (TE) ionization chambers. The film badge contains an aluminum and a cadmium filter and an open window. The DuPont sensitive 555 and insensitive 1290 beta/gamma films are used along with the Kodak NTA film packet. Test assemblies containing the film badges and the dosimeters were placed in experimental areas around the two BNL proton synchrotrons. Machine parameters that may influence the data are recorded. Film badge data are analyzed and the assigned dose, as indicated by standard method of film badge interpretation, was compared with the absorbed dose as determined by the ionization chambers. Quality factors implied by the standard personnel monitoring procedure was found to vary from one to 30. These implied quality factors were also compared with measured quality factors, where such information is available. Various factors complicate the interpretation of film badges exposed at the synchrotrons. For example, maintenance work in tunnels during accelerator shutdown results in relatively high gamma exposures which are a result of the induced activity of the machine components. Due to the lack of electronic equilibrium in the area and the occasional occurrence of thermal neutrons, the use of the open window and cadmium portions of the film badge is restricted, leaving only the aluminum filter for proper gamma evaluation at the synchrotrons. Also, the economical procedure of not reading the NTA film in personnel film badges, when no exposure is indicated by the beta/gamma film, is not valid at high energy synchrotrons. Neutron exposures, up to several hundred mrem, have been measured by film badges worn by radiation workers, without any positive exposure indicated on the beta/gamm film. Author (NSA)

N66-27606# Hughes Aircraft Co., Culver City, Calif.
HUMAN PERFORMANCE UNDER RANDOM AND SINUSOIDAL VIBRATION Final Technical Report, Apr. 1964–May 1965
A. Z. Wiesz, Connie Goddard, and R. W. Allen Wright-Patterson AFB, Ohio. AMRL, Dec. 1965 61 p refs
(Contract AF 33(615)-1908)
(AMRL-TR-65-209; AD-631457) CFSTI: HC $3.00/MF $0.75

Two experiments tested human subjects under whole-body vertical vibration to: (1) compare effects on performance of 5 cps sinusoidal, 5 cps random amplitude, and 4–12 cps random vibration equated on the basis of power, and (2) determine acceleration levels at which significant performance decrements are found for each type of vibration. The complex experimental task required two-dimensional compensatory tracking, visual monitoring, and auditory monitoring during 20 minute vibration exposures at levels equated to 5, 15, 25, and 30 percent of the 1 minute human tolerance values for 5 cps sinusoidal vibration. Performance decrements under vibration were restricted to tracking, the most demanding component of the task complex. Tracking performance deteriorated with increasing acceleration levels of each type of vibration. Overall performance differences associated with the different types of vibration equated on the basis of power were not significant. A number of task and procedural variables, including task difficulty, work–rest cycle, and prior experience appear to be important determinants of performance capabilities and fatigue effects found in vibration studies, indicating a need for further investigation of these variables. Author (TAB)

N66-27641# School of Aerospace Medicine, Brooks AFB, Tex.
ALGAL BIOREGENERATIVE SYSTEMS Status Report, 1952–1964
Richard L. Miller and Calvin H. Ward Feb. 1966 28 p refs
(SAM-TR-66-11; AD-631191) CFSTI: HC $2.00/MF $0.50

Algae may be used for partial regeneration of man's requirements for life in a closed environment. Feasibility has been demonstrated with model systems, but established principles of algal metabolism impose severe restrictions on the design of thermodynamically efficient, low-volume and low-weight algal gas exchangers. Review of available data on photosynthetic gas exchangers now permits verification of design parameters predicted almost 10 years ago. Experimentally achievable values of electrical efficiency are only a fraction of the theoretical, significant improvement

over or attainment of theoretical values will require major improvement in the conversion of electrical energy into light energy or conversion of light energy into chemical energy by the green plant. Development of a basic design theory would be greatly simplified by a definite mission-oriented goal—e.g., a planetary base. At present there is no material advantage among existing algal exchangers since criteria used for design require compromises of weight, volume, and power. Most algal gas exchangers are inadequately described. More experimental data, obtained by extensive operation of prototype systems, are needed for accurate logistic evaluation. Weight, volume, and power flexibility may ultimately be of advantage in the design of life-support systems for specific space missions, provided long-term reliability can be demonstrated. Author (TAB)

N66-27644# Aviation Safety Engineering and Research, Phoenix, Ariz.

IMPACT TEST METHODS AND RETENTION HARNESS CRITERIA FOR U.S. ARMY AIRCREWMAN PROTECTIVE HEADGEAR Final Technical Report

Joseph L. Haley, Jr. and James W. Turnbow Fort Eustis, Va., Army Aviation Material Labs., Mar. 1966 55 p refs
(Contract DA-44-177-AMC-254(T))
(AvSER-65-15; USAAVLABS-TR-66-29; AD-631493)

On the basis of simple analyses and some experimental testing, recommendations are made for the design and testing of helmet retention harnesses. A 'collar-type' retention harness is recommended, and two tests are suggested as a method of insuring a good design. Impact tests were conducted by an impactor-drop method and a head-form drop method. These test methods employ one movable piece and one fixed piece rather than two movable pieces as are currently used by most test agencies. On the basis of the impact test results, it is recommended that the impactor-drop method be used for the qualification of U. S. Army aircrew helmets. Probable head impact velocities and impact surfaces are discussed, and impact test conditions are specified. Author (TAB)

N66-27667# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.

VOLUMETRIC WORKSPACE STUDY. PART II: OPTIMUM WORKSPACE CONFIGURATION FOR USE OF WRENCHES Final Report

William N. Kama Dec. 1965 29 p ref
(AMRL-TDR-63-68 (II); AD-631476) CFSTI: HC $2.00/MF $0.50

The study was conducted to establish the functional relationship between available workspace and the time required to remove and to replace two self-locking hexagonal nuts. The experiment involved the following variables: (a) wrench type, a 6-inch long open-end or 7-inch long ratchet; (b) workspace depth, 15, 30, and 45 cm (6, 12, and 18 inches); (c) aperture size, 20, 25, 30, 35, and 40 cm (8, 10, 12, 14, and 16 inches); and (d) task location within the workspace (left side, right side, top, bottom, or rear). Twenty-one subjects were divided into three groups of seven subjects each. For a given group, depth was held constant as subjects using their right hand performed the task under 25 different conditions. These conditions were determined by the combination of five aperture sizes and five different task locations. The 25 conditions were performed twice, once using the open-end and once using the ratchet wrench. Major results of this study (within the range of conditions explored) are as follows. First, regardless of the type of wrench used, work times decreased as aperture size increased. However, increasing aperture size beyond 30 cm (12 inches) did not appreciably shorten work times. Work times using the ratchet wrench were considerably faster than those obtained with the open-end wrench. Second, the best overall performance times were obtained at the rear location. The next best times were obtained at the left side and bottom locations, while the right side and top locations yielded the worst times. Author (TAB)

N66-27703# Cincinnati Univ., Ohio.

AN EVALUATION OF PROGRAMED INSTRUCTION FOR TEACHING FACTS AND CONCEPTS Final Report, Apr. 1964–Aug. 1965

James N. Jacobs (Cincinnati Public School System), Kirk A. Johnson, and John S. Abma (Aerospace Med. Res. Labs.) Wright-Patterson AFB, Ohio. AMRL, Dec. 1965 34 p refs
(Contract AF 33(657)-10234)
(AMRL-TR-65-222; AD-631414) CFSTI: HC $3.60/MF $0.50

The study evaluated five methods of teaching an academic topic ('Bill of Rights') to high school classes. The five methods were: (1) linear program in class, (2) linear program as homework plus discussion in class, (3) text version of linear program in class, (4) text version of linear program as homework plus discussion in class, and (5) conventional lecture–discussion method in class. The linear program alone provided the best results when measured both for the learning of factual material and general concepts about the topic. The linear program was best for high, intermediate, and lower levels of scholastic aptitude. Author (TAB)

N66-27706# School of Aerospace Medicine, Brooks AFB, Tex.

AN ECONOMICAL TIME STANDARD FOR CALIBRATING CARDIOTACHOMETERS AND BIOLOGIC DATA RECORDINGS, 10 AUGUST–1 DECEMBER 1965

Alfonso Angelone Feb. 1966 17 p refs
(SAM-TR-66-10; AD-631197) CFSTI: HC $1.00/MF $0.50

A single-stage pulse-frequency divider is reported which will divide 60 pulses/sec by 60 yielding 1-second pulses with reliability from −40 to +80°C. Division by 300, yielding pulses at 5-second intervals, is reliable from +5 to +45°C. A triple-division circuit is then developed from the single-stage divider concepts. This circuit is incorporated into a calibration instrument which produces pulses in a frequency range useful for time calibration of biological data. When the instrument is used as a cardiotachometer calibrator, pulses are available from 30 to 300 pulses/min; as a time marker, periods range from 50 msec to 10 sec. The circuitry remains stable over a line voltage fluctuation of ±20% and a temperature range of −15 to +80°C. The output pulse, available as either a negative or positive going pulse, is 8.33 msec wide, has an amplitude greater than 10 v, has rise and fall times of the order of 10 microsec, and exhibits a typical timing accuracy of ±0.02%. Author (TAB)

N66-27709# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DEVICE FOR BIOELECTRICALLY CONTROLLING, E.G., OF PROTHESES

Ye. P. Polyan 19 Aug. 1965 6 p Transl. into ENGLISH from Russian patent no. 163326 (Appl. no. 843963/31-16, 27 Jul. 1963) 2 p
(FTD-TT-65-508/1+2+4; AD-620857) CFSTI: HC $1.00/MF $0.50

The object of the invention is a device for bioelectrically controlling, for example protheses, having resistor, capacitor, and transistors, and which is characterized by the fact that, for the purpose of assuring subsequent control of two pairs of movements from two independent signal sources, an electronic switch-relay is mounted in it, built on two transistors, being activated at simultaneous feeding of two signals of negative polarity and switching over the control from one pair of movement to another. For the purpose of controlling the second pair of movements, an RC (circuit), which maintains the circuit in switched over condition for a period of time necessary to execute the beginning of the movement, and automatically returning the circuit into initial position when the feeding of the control signal has been discontinued. Author (TAB)

N66-27787# Bureau of Social Science Research, Inc., Washington, D. C.

VOLUNTEERS FOR A HIGH RISK SPORT

Samuel Z. Klausner Jan. 1966 44 p refs

(Contract AF 49(638)-1510)

(AFOSR-66-0121; AD-631049) CFSTI: HC $2.00/MF $0.50

Sport parachutists tend to be over-represented in the Western region of the United States. They are, by and large, relatively young males who look upon the sport as a masculine expression. The sport is objectively dangerous, as measured by the accident rate, and is subjectively perceived as such. Sport parachutists tend to be single-minded in their attitude to the sport, sometimes giving it priority over their commitment to family roles. Press reportage emphasizes the spectacular and exhibitionistic aspects of parachuting rather than its competitive sport aspects. Newspapers see the activity as exhibiting fun and 'guts' and as dangerous. Author (TAB)

N66-27868# Bureau of Social Science Research, Inc., Washington, D. C.

THE IMPACT OF THE MEANS OF RECRUITMENT ON PERFORMANCE IN A DANGEROUS SPORT: SOCIAL, ENTHUSIASTIC AND EXHIBITIONIST SKYDIVERS Technical Report, 1963–1966

Samuel Z. Klausner Jan. 1966 32 p refs

(Contract AF 49(638)-1510)

(AFOSR-66-0122; AD-631019) CFSTI: HC $2.00/MF $0.50

Many skydivers are recruited by friends; relatively few are recruited through the mass media. Written materials are likely to attract older and more educated individuals to the sport. Individuals recruited by their friends tend to place the social group ahead of the sport and may shift to another sport rather than change their group when faced with a choice. Those who are recruited through written materials tend to be more active and enthusiastic skydivers. Those recruited through television are more interested in the exhibitionistic aspects of skydiving and, in their personalities, tend to be more passive. Those recruited by friends are more likely to be 'locals', concerned with the activity of their immediate skydiving group, while those recruited through the mass media are more likely to be 'cosmopolitans', concerned with national aspects of skydiving. Author (TAB)

N66-28113# Bolt, Beranek, and Newman, Inc., Van Nuys, Calif.

ANALYSIS OF COMMUNITY AND AIRPORT RELATIONSHIPS/NOISE ABATEMENT Final Technical Report, May 1964–Apr. 1965

Dwight E. Bishop et al Dec. 1965 385 p refs

(Contract FA-WA-4409)

(SRDS-RD-65-130)

This report describes research directed towards gaining an understanding of why and how individuals and communities react to noise, and toward determining feasibility of developing improved methods for predicting community response to noise. Also presented are results of acceptability judgment tests in the vicinity of Los Angeles International Airport applications of a decision-flow methodology to analysis of seventeen case histories of community-decision making, noise reduction measurements made in a number of school, motel, and residential rooms, computer studies of noise environment generated by jet takeoffs, factors determining the duration of takeoff and flyover noise signals, and some applications of methods for determining land use compatibility with aircraft noise. Author

N66-28140# Argentina. Comision Nacional de Energia Atomica, Buenos Aires.

KIDNEY SCINTILLATION COUNTER [CENTELLOGRAFIA DEL RINON]

A. J. Olivari, V. Pecorini, A. Chwojnik, H. Garcia Del Rio, and H. Testa 1966 21 p refs In SPANISH

(CNEA-170) CFSTI: HC $1.00/MF $0.50

Renal scintillography is a new technique which expands the possibilities of studying the physiopathology of the kidney. It is also an attractive method for studying cysts, tumors, and congenital anomalies, and can obtain valuable information on the functional capacity of an organ. The radionuclides, equipment and methods, radiation dose, and the interpretation of the scintillograms, including some examples, are discussed. Transl. by R.N.A.

N66-28259# Illinois Univ., Urbana. Group Effectiveness Research Lab.

THE EFFECTS OF INTER-GROUP COMPETITION IN QUASI-THERAPEUTIC LEADERS ON THE ADJUSTMENT OF SMALL MILITARY GROUPS

Doyle W. Bishop, James M. Alsobrook, and Fred E. Fiedler Jan. 1966 43 p refs

(Contract DA-49-193-MD-2060)

(TR-20; AD-631741) CFSTI: HC $2.00/MF $0.50

The study investigated the effects of two variables (intersquad competition vs. non-competition, and quasi-therapeutic vs. non-therapeutic squad leaders) on the adjustment, interpersonal relations, and task effectiveness of military squads. The covariance control variables were the dependent variable's own pretest counterpart and a measure of trainees' perceived harassment. The major results were: (1) The competitive activity and the manner in which it was implemented by the cadre of the experimental companies significantly increased perceptions of harassment by trainees in the competitive squads. (2) When perceived harassment was statistically controlled by analysis of covariance, the adjustment and task effectiveness of the competitive squads improved significantly relative to the control squads. The improved adjustment appeared to be primarily in the task-related areas. No improvement in interpersonal relations was found for the competitive squads. (3) No reliable main effects were found for the quasi-therapeutic leader manipulation. (4) Some interactive effects of competition and quasi-therapeutic leadership were found. Author (TAB)

N66-28271# System Research, Ltd., Richmond (England).
RESEARCH ON CYBERNETIC INVESTIGATION OF LEARNING AND PERCEPTION Annual Summary Report No. 3
Gordon Pask, M. Elstob, and George L. Mallen 15 Feb. 1966 104 p refs
(Contract AF 61(052)-640)
(AFOSR-66-0644; AD-631634) CFSTI: HC $4.00/MF $0.75

Research is summarized on models that describe the learning of a structured skill and on simulations of populations of automata that become more complex as they develop. Applicability and limitations on a simple learning model based on terms of continuous, information-like measures are discussed. The model considers the contribution from learning of the i-th skill to learning of the j-th. Limitations arise for the description of learning of higher-order concepts. The relevance of statistical and homeostatic approaches to the description of learning and adaptation is considered; each is viewed as contributing to the characterization of a real-life population of organisms. The simulation model shows that individual automata do not learn on their own but in cooperating groups. The elaborate population that is postulated shows stability over a larger range of cost parameter values in an unconstrained environment than in a constrained environment. A gregarious automation is described that has a sensory system (sensitivity to density of population) and a memory system; significance is associated with properties that remain invariant or exhibit regular and correlated transformation. Author (TAB)

N66-28290# HRB-Singer, Inc., State College, Pa.
GUIDEBOOK FOR THE COLLECTION OF HUMAN FACTORS DATA Final Report
Louis B. Meyers, Robert G. Carter, and Robert S. Hostetler Jan. 1966 122 p refs
(Contract Nonr-4751(00))
(PTB-66-3; AD-631023) CFSTI: HC $4.00/MF $0.75

The guidebook was developed primarily as a reference to aid the Project Officer in the assessment of human factors effects on system performance and in the isolation of the causal factors. There are three sections to this guidebook, each serving a different purpose. Section I provides the necessary background information and sets the perspective for the use of the techniques and materials presented in Section II. This section contains the tools and techniques for system evaluation. This includes methods for obtaining time, accuracy, and maintenance data as well as the techniques for analyzing and interpreting these data. Methods for obtaining qualitative data through questionnaires and checklists are also contained in this section, including sample questionnaires and checklists. The third section (Section III) contains a fairly detailed example of the application of the previously described techniques. Also included are rather complete lists of test objectives and criteria measures. Author (TAB)

N66-28307# Human Engineering Labs., Aberdeen Proving Ground, Md.
A FIELD SURVEY OF AIR-TO-GROUND TARGET-DETECTION PROBLEMS
Samuel A. Hicks and Calvin G. Moler Jan. 1966 31 p refs
(TM-1-66; AD-631361) CFSTI: HC $2.60/MF $0.50

Twenty enlisted men were tested on a target-detection test at Ford Ord, California. Each subject was required to detect ten targets appearing at ranges of 1000 meters to 2100 meters. Forty trials were run. The results indicate that detection and identification depend on more than mere distance between target and observer. Not only did a target's size and form affect its detectability, but it appeared that the main cause of misidentifications was differing targets with similar sizes and forms. These results are related to current literature, and their implications for the course of the program are examined. Author (TAB)

N66-28314# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
EFFECTIVE TECHNICAL COMMUNICATIONS. MECHANICAL DESCRIPTION, EXPERIMENT II
Richard M. Davis 1965 131 p refs
(AFIT-TR-65-1; AD-631238) CFSTI: HC $4.00/MF $1.00

The effects of variables upon the effectiveness of a written technical communication were tested in a 3X2X2X2 factorial experiment. The subject matter was a description of a simple mechanism. The variables were (1) the manner in which the size and shape of the machine and its parts were presented, (2) introduction (present or absent), (3) internal orienting material (present or absent), and (4) headings (present or absent). The effectiveness of the message was measured by (1) comprehension, (2) reading time, (3) the readers' impression of the author's knowledge of the subject matter, and (4) the readers' impression of the author's competance as a writer. The audiences tested were (1) bright young people with known technical interests, (2) bright young people without known technical interests, (3) young men of average intelligence known to have technical interests, and (4) young men of below average intelligence known to have technical interests. The structural aids (introduction, internal orientation, and headings) contributed little to the effectiveness of the message as measured by the criteria used, and they even proved harmful in some instances. The experimental method used shows promise as a fairly reliable predictive instrument. Author (TAB)

N66-28380*# Northrop Space Labs., Hawthorne, Calif.
THE DEVELOPMENT OF AN ADVANCED SYSTEM TO COOL A MAN IN A PRESSURE SUIT
R. B. Olson, J. Felder, and C. F. Lombard [1966] 50 p
(Contract NAS9-4925)
(NASA-CR-65382; NSL-66-73) CFSTI: HC $2.00/MF $0.50
CSCL CSCL 06K

A feasibility study was conducted and a configuration developed of a conductive cooling system for cooling a man in space. The results of the bench tests and the single man test demonstrate the feasibility of this concept, plus the need for further development work to produce a model having the desired efficiency, reliability, and safety for space use. Author

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N66-26975# Bureau of Mines, Berkeley, Calif. Thermodynamics Lab.
LOW-TEMPERATURE HEAT CAPACITIES AND ENTROPIES AT 298.15°K OF FERROUS MOLYBDATE AND FERROUS TUNGSTATE

William W. Weller 1966 14 p refs
(BM-RI-6782)

Heat capacities of ferrous molybdate ($FeMoO_4$) and ferrous tungstate ($FeWO_4$) were measured over the temperature range 51° to 298.15°K. Ferrous tungstate has a lambda type heat capacity anomaly at 74°K. The 298.15°K entropies are: $FeMoO_4$, 30.9 cal/deg mole and $FeWO_4$, 31.5 cal/deg mole. Author

N66-27011# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.
ELECTRODEPOSITION OF ALUMINUM FROM FUSED-SALT ELECTROLYTES CONTAINING ALUMINIUM CHLORIDE
P. C. Good, M. O. Butler, and L. A. Yerkes 1966 20 p refs
(BM-RI-6785)

Work was done to determine conditions necessary for efficient electrodeposition of aluminum from fused chloride electrolytes. Aluminum was deposited from a molten chloride salt electrolyte over a temperature range of 150° to 750°C. At lower temperatures in a heat-resistant glass cell, aluminum was deposited on stainless steel and on aluminum cathodes. The deposit was recovered in the form of light, feathery dendrites that could not be consolidated. At 750°C, molten aluminum was deposited at cathode current efficiencies as high as 90 to 100 percent on titanium diboride cathodes and in molten aluminum cathodes. Nitride-bonded silicon carbide was the best cell material, although porcelain was also used. The electrolyte consisted of a mixture of sodium and potassium chlorides in 1 to 1 mole ratio, containing aluminum chloride in concentrations ranging from 2 to 30 weight-percent in cells holding up to 1,000 grams of electrolyte. Generally favorable results were attained in studies made at temperatures greater than the melting point of aluminum. Author

N66-27035*# National Aeronautics and Space Administration, Washington, D. C.
CYANIC ACID SYNTHESIS IN A FLUIDIZED BED REACTOR
M. Nakagawa Jul. 1963 13 p refs Transl. into ENGLISH from Kagaku Kogyo (Japan) no. 9, Sep. 1956 p 29–33
(NASA-TT-F-8496) CFSTI: HC $1.00/MF $0.50 CSCL 07C

An alumina catalyst was prepared for the direct synthesis of cyanic acid from methane and ammonia. Hydrated alumina ($Al_2O_3 3H_2O$) was dissolved in caustic soda. The solids were filtered out, and the filtrate containing pure sodium aluminate was hydrolyzed with dilute HCl. The aluminum hydroxide was precipitated and dried, then sintered at 300°C in a muffle furnace. Upon washing, the catalyst broke up into fine sand-like grains. Fifty cc of 30 to 100 mesh size of this alumina catalyst was used with a 400 cc/min methane flow and a 200 cc/min ammonia flow to prepare cyanic acid. The yield of cyanic acid was hardly changed after 100 hours of reaction time. The average cyanic acid yield per ammonia consumed was 77%. The rate of decomposition of the ammonia was very small. The quantity and composition of the exhaust gas were found to be fairly constant, that is, 50 liters/hr with a composition of 27% methane and 65% hydrogen. This proves that there is very little methane decomposition at the catalyst surface, and that this catalyst is characteristically efficient in promoting the cyanic acid synthesis. I.v.L.

N66-27049*# Southwest Research Inst., San Antonio, Tex.
ANALYSIS OF NITROGEN TETROXIDE SAMPLES Final Report
Herbert C. Mc Kee and William A. Mc Mahon 15 Apr. 1966 31 p
(Contract NAS9-5422)
(NASA-CR-65372) CFSTI: HC $2.00/MF $0.50 CSCL 07B

A study was conducted to develop methods of trace analysis and to measure impurities in N_2O_4 samples. In order to see if variations in trace impurities in different samples of N_2O_4 could be related to the stress corrosion pattern in titanium alloy tanks used for this material. It was originally anticipated that one gram of residue could be obtained by evaporating one liter of sample. The amount of residue obtained averaged from 10 to 20 milligrams per liter. This made it impossible to complete the analytical work and made it less likely that trace impurities in the material might account for differences in corrosion characteristics. The analysis was shifted to N_2O_4 with emphasis on determining NO, since some evidence existed that the amount of NO might be important in determining corrosion patterns. A method was developed to determine NO in N_2O_4 using a mass spectrometer. This was accomplished by modifying the instrument's inlet system and by developing suitable handling techniques. R.N.A.

N66-27089# Argonne National Lab., Ill.
REVIEW OF STATUS OF SELF-DIFFUSION IN Uβ, UN, UO_2, AND UC
C. M. Walter Nov. 1965 29 p refs
(Contract W-31-109-ENG-38)
(ANL-7094) CFSTI: HC $2.00/MF $0.50

The nature of imperfections and their contribution to the diffusion mechanism are of primary interest in a self-diffusion study. With this in mind, the literature on Uβ, UN, UO_2, and UC was reviewed. The state of knowledge of UO_2 was found to be much more advanced than for the other materials considered. NSA

N66-27092# Oak Ridge National Lab., Tenn.
DECONTAMINATION OF THE ORNL MOLTEN-SALT FLUORIDE-VOLATILITY PILOT PLANT AFTER PROCESSING IRRADIATED ZIRCONIUM–URANIUM ALLOY FUEL
S. Mann and E. L. Youngblood Feb. 1966 43 p refs
(Contract W-7405-ENG-26)
(ORNL-3891) CFSTI: HC $2.00/MF $0.50

The molten-salt fluoride-volatility process for recovering uranium from irradiated zirconium- or Zircaloy-2-clad fuel elements was demonstrated successfully in the ORNL Molten-Salt Fluoride-Volatility Pilot Plant. Decontamination methods that were used twice, following two periods of hot operation, to reduce radiation levels in excess of 2000 R/hr to values sufficiently low to permit extensive direct maintenance and equipment modification are described. Radiation dosage to individuals who did the mechanical work in no case exceeded the quarterly 1.3-R allowance. Final backgrounds were less than 100 mR/hr in the majority of cell locations, with maximum readings of 500 mR/hr adjacent to some parts of the process equipment. The decontamination sequence was based on laboratory development work. It includes flushing with a molten salt, followed by treatment with three types of aqueous solutions for removing salt film, metal scale, and deposited radiation emitters. This procedure is suitable for radiation levels at least as high as those encountered in the two radioactive operating periods cited. Author (NSA)

N66-27094# Oak Ridge National Lab., Tenn.
LARGE SCALE PREPARATION OF HIGH PURITY ^{131}I AND ^{133}Xe BY SORPTION TECHNIQUES

F. N. Case and E. H. Acree Jan. 1966 19 p refs
(Contract W-7405-ENG-26)
(ORNL-3840) CFSTI: HC $1.00/MF $0.50

Isolation of ^{131}I and ^{133}Xe from fission product mixtures was accomplished by sorbing the ^{131}I on platinum and the ^{133}Xe on charcoal or on a molecular sieve. Very high radiochemical purity is obtained by this method. The process is easily controlled to minimize the loss of ^{131}I to waste gas streams and compact equipment allows manipulator cell operation. Author (NSA)

N66-27102# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.
STABILITY STUDIES OF HIGHLY RADIOACTIVE ALUMINA CALCINE DURING HIGH TEMPERATURE STORAGE
M. W. Wilding and D. W. Rhodes Jan. 1966 17 p refs
(Contract AT(10-1)-205)
(IDO-14670) CFSTI: HC $1.00/MF $0.50

Stability of highly radioactive alumina calcine from the Waste Calcining Facility was studied in a temperature range from 600° to 1200°C. Strontium-90 and cerium-144 were not volatile. Cesium-137, ruthenium-106, boron, mercury, and nitrate were volatile to some degree over this temperature range. The alumina produced in the WCF was amorphous but converted to alpha alumina at 800°C and higher temperatures. Author (NSA)

N66-27107# Mallinckrodt Chemical Works, Weldon Spring, Mo. Uranium Div.
PROCESS DEVELOPMENT Quarterly Progress Report, Jul.–Sep. 1965
1 Nov. 1965 34 p refs
(Contract W-14-108-ENG-8)
(MCW-1493) CFSTI: HC $2.00/MF $0.50

The effects of several sample preparation variables on the determination of crystallite size are discussed. A method is described for determining crystallite size directly on a sol. A revised method of calculating crystallite size was observed to give values that correlate better with denitration temperatures and other variables than the values calculated normally. Crystallite sizes calculated by the revised method were unchanged when the samples were milled or converted to sols. Information on process development is presented in three sections. Separate abstracts were prepared for each section. A system for energy dispersion analysis was assembled and used with the Cambridge electron microprobe. This system included a high-resolution flow counter with an ultra-thin Formvar window, a low-noise Tennelec preamplifier, and a Packard 400-channel analyzer. One of its primary purposes was to facilitate the analysis of elements that have atomic numbers lower than Mg. With this equipment, rates as high as 87,000 counts per second were observed for C Kα X-rays emitted by high-density graphite. Carbides and oxides of U were identified by analysis of the light elements. A spectrochemical method was developed for simultaneous determination of Ca, Li, and K in high-purity Th compounds. The method is implemented by a focal-plane filter mounted at the photographic plate location of K 7698.98 Å. This arrangement eliminates second-order cyanogen band interference and permits the simultaneous determination of the three listed elements in one efficient spectrogram. Author (NSA)

N66-27114# Atomic Energy Commission, New Brunswick, N. J.
SPECTROPHOTOMETRIC DETERMINATION OF GALLIUM IN PLUTONIUM–GALLIUM ALLOY
C. E. Pietri and A. W. Wenzel Nov. 1965 11 p refs
(NBL-228) CFSTI: HC $1.00/MF $0.50

Macro amounts of gallium in plutonium–gallium alloys were determined by an improved rhodamine B chlorogallate–benzene extraction-spectrophotometric method. The alloy is dissolved in hydrochloric acid, converted to the nitrate, and separated from the gallium and impurities by adsorption on Dowex-1 anion resin in 8*N* HNO_3. After dilution to the optimum concentration range the effluent is used for the gallium determination and an emission spectrographic impurity analysis. The plutonium is assayed after its elution from the resin bed. The relative standard deviation was within 2.2% for samples in the 3–15 μg gallium range with no apparent bias. Analyses of alloy samples for gallium, plutonium, and impurities gave material balances of 100.1±0.2%. Author (NSA)

N66-27122# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.
LEACHABILITY OF GLASS PREPARED FROM HIGHLY RADIOACTIVE CALCINED ALUMINA WASTE
B. E. Paige Feb. 1966 40 p refs
(Contract AT(10-1)-205)
(IDO-14672) CFSTI: HC $2.00/MF $0.50

Alumina-phosphate glass was prepared from full-level radioactive calcine produced in the Waste Calcining Facility at the Idaho Chemical Processing Plant. The glass was prepared from 25 weight percent alumina calcine, 40.5 percent P_2O_5 and 18.6 percent Na_2O added as $NaH_2PO_4 \cdot H_2O$, and 15.9 percent PbO. The details of preparation and the effect of radiation and heat treatment on the glass are reported. Leaching data obtained for fission products and the glass components are compared for the glass in distilled water at 25° and 94°C. A specially designed apparatus which circulated the water continuously was used. The high level of activity made it feasible to use a single molded piece permitting the surface area and other experimental conditions to be defined to a far greater degree than is feasible with the crushed glass techniques required for low levels of activity. Devitrification by heating for 30 days at 450° C was found to have no effect on the leaching rate. Author (NSA)

N66-27193*# Pittsburgh Univ., Pa. Space Research Coordination Center.
IONOSPHERIC REACTION RATES IN THE LIGHT OF RECENT MEASUREMENTS IN THE IONOSPHERE AND THE LABORATORY
T. M. Donahue 27 May 1965 39 p refs
(Contract NASr-179; Grant NsG-416)
(NASA-CR-63414; SRCC-5) CFSTI: HC $2.00/MF $0.50
CSCL 07D

An attempt is made to obtain sets of ion-molecule reaction rates and recombination coefficients consistent with recent mass spectrometric ion data between 120 and 220 km. It is found that recently measured rates of 3×10^{-12} cm^3/sec for formation of NO^+ from $O^+ + N_2$ and 4×10^{-13} cm^3/sec for charge exchange in $N_2^+ + O_2$ require that the rate of formation of NO^+ in the $N_2 + O$ reaction be larger than 5×10^{-10} cm^3/sec at 300°. Daytime conditions are susceptible to explanation with a wide range of possible rates. The observations require that the dissociative recombination coefficient for NO^+ decrease from 5×10^{-7} cm^3/sec at 300° as $T^{-3/2}$ and for O_2^+ decrease from 3.5×10^{-7} cm^3/sec as $T^{-2/3}$. The nighttime ionosphere can be explained with the same recombination coefficients. The nocturnal NO^+ maximum in the E region then requires an ionization of N_2 at the rate of 8–10 ion pairs/cm^3 sec. N_2^+, O_2 charge

exchange reaction must be slow and the N_2^+O ion atom interchange reaction rapid unless NO^+ production from N_2^+, O_2 and O_2^+, NO reactions is efficient. A source of ionization is also required above 180 km to explain the appearance of N_2^+ at night. Author

N66-27225*# National Aeronautics and Space Administration, Washington, D. C.
STUDY OF CYANIC ACID SYNTHESIS BY FIXED CATALYST METHOD
M. Otake, M. Nakagawa, T. Ohara, H. Hareda, and M. Ninomiya Jul. 1963 11 p Transl. into ENGLISH from Kogyo Kagaku Zasshi (Tokyo), v. 59, no. 1, 1956, p 121–124
(NASA-TT-F-8494) CFSTI: HC $1.00/MF $0.50 CSCL 07C

Cyanic acid synthesis from methane and ammonia by the fixed-bed catalyst method was investigated. Results indicate that: (1) The ordinary alumina catalyst is unsuitable for practical use from the standpoints of cyanic acid yield and durability. (2) The silica, in the case of an alumina–silica catalyst, distinctly aided the catalytic action. Despite the high cyanic acid yield which could be obtained, catalytic activity declined with time. The cause of this decline in activity was attributed to a solid-phase reaction between the alumina and the silica. (3) Alumina–thoria, as a catalyst, produced a fairly high cyanic acid yield. The decline in catalytic activity, due to carbon adsorption, was easily remedied by air-burning the carbon. (4) It was discovered that a small amount of carbon disulfide or hydrogen sulfide in the raw materials increased the cyanic acid yield considerably. I.v.L.

N66-27233*# National Bureau of Standards, Washington, D. C. Electrochemistry Section.
A STUDY OF ELECTROCHEMICAL PROCESSES IN SILVER–CADMIUM SECONDARY CELLS
Earl M. Otto 14 Jul. 1965 26 p refs
(NASA Order S-70008-C)
(INASA-CR-62027) CFSTI: HC $2.00/MF $0.50 CSCL 07D

Efforts during this period were directed toward a study of the discharge characteristics of the silver–cadmium secondary cells. An experiment was performed to conduct the normal 300 ma charge and 1.00 amp discharge at room temperature. This was followed by observations of the effect on charge and discharge resulting from changes in rates of charge and discharge, in temperature, in electrolyte level, in electrolyte concentration, and in partial charge and discharge in both the AgO–Ag_2O and Ag_2O–Ag ranges. All cell tests were conducted in duplicate. R.N.A.

N66-27248# Oak Ridge National Lab., Tenn.
PREPARATION OF UO_2 MICROSPHERES BY A SOL-GEL TECHNIQUE
J. P. Mc Bride, comp. Feb. 1966 57 p refs
(Contract W-7405-ENG-26)
(ORNL-3874) CFSTI: HC $3.00/MF $0.75

Uranium oxide microspheres were prepared from both natural and enriched uranium by a sol–gel technique. The urania sols were prepared by precipitating hydrous uranium dioxide from uranous nitrate or nitrate–formate solutions, washing the precipitate to the point of incipient peptization, and heating the washed filter cake at 60° to 65°C to form a sol. Gelled microspheres were formed by dispersing the sol as drops in a column of drying solvent and fluidizing the drops during drying and gellation. The gelled microspheres were then fired to strong, dense UO_2 microspheres. Gelled microspheres and fired products were characterized by means of chemical analysis and physical methods which included thermogravimetric analysis, density measurements, crush strength determinations, X-ray diffraction, and metallographic examination. The preferred method of sol preparation was from nitrate–formate solution. Completely satisfactory sphere drying and firing conditions are still under development. Author (NSA)

N66-27251# Argonne National Lab., Ill.
GLOVEBOX AMALGAMATION FOR THE DETERMINATION OF OXYGEN IN ALKALI METALS
Ben D. Holt Dec. 1965 10 p refs
(Contract W-31-109-ENG-38)
(ANL-7123) CFSTI: HC $1.00/MF $0.50

The use of a new type of amalgamation vessel for the determination of oxygen in sodium and potassium is described. The metal is amalgamated immediately after sampling inside a helium-filled glovebox, thereby terminating the risk of significant oxygen contamination by subsequent handling and exposure to the glovebox atmosphere. End-point sensitivity is enhanced by titrating the oxide residue in the same vessel, thus avoiding dilution by wash water that would be required in the transfer to a titration flask. The described technique yielded generally lower and more reproducible values in the low-ppM range than did the older, vacuum-line, amalgamation procedures. Author (NSA)

N66-27252# Los Alamos Scientific Lab., N. Mex.
THE DETERMINATION OF NITRIDE NITROGEN IN PLUTONIUM METAL, ALLOYS, AND COMPOUNDS
E. A. Hakkila and G. R. Waterbury 1 Mar. 1966 12 p refs
(Contract W-7405-ENG-36)
(LA-3452) CFSTI: HC $1.00/MF $0.50

Nitride nitrogen in plutonium metal alloys, or compounds is separated by steam distillation as ammonia, trapped in a boric acid solution, and measured either spectrophotometrically using Nessler's reagent or by titration with standardized acid, depending upon the quantity of nitrogen present. The samples are dissolved and digested in a mixture of hydrochloric and perchloric acids, and the solutions are made strongly alkaline prior to the steam distillation. For the spectrophotometric measurement, the color-forming reagent is added to the boric acid solution, and the absorbance is measured at a wavelength of 410 mμ. The molar absorptivity of the colored species is 3500. The standard deviations in measuring 1 μg to 100 μg. of nitrogen spectrophotometrically in 1-gram samples range from 30% to 3%. For the titrimetric measurement, the boric acid solution containing the ammonia is titrated directly with dilute standardized hydrochloric acid. The relative standard deviations of the titration method in measuring 100 μg to 2000 μg of nitrogen are in the range from 6% to 0.7%. Results for nitrogen in plutonium metals obtained by the spectrophotmetric method are essentially equal to the values obtained by a Dumas method, indicating that the nitrogen exists predominantly in the combined or nitride form. Author (NSA)

N66-27253# Los Alamos Scientific Lab., N. Mex.
THERMODYNAMIC PROPERTIES OF Pu COMPOUNDS FROM EMF MEASUREMENTS. I: Pu VERSUS Ag IN LiCl-KCl EUTECTIC
G. M. Campbell and J. A. Leary 1 Mar. 1966 18 p refs
(Contract W-7405-ENG-36)
(LA-3399) CFSTI: HC $1.00/MF $0.50

The EMF of the cell $Pu/Pu^{+3}(x_1)$, LiCl–KCl//LiCl–KCl, $Ag^+(x_2)/Ag$ was determined over the temperature range

697 to 729°K and over a Pu^{+3} mole fraction (x_1) range of from 5.94×10^{-4} to 21.5×10^{-4}. The Ag^+ concentration in the reference electrode was maintained at a constant mole fraction of 5.68×10^{-4}. The reversible EMF of the cell can be expressed as $E_T=(2.19-1.004\times10^{-3}T)+(RT/3F)\ln x$. In addition, the EMF of the cell Ag/Ag^+ (x_2) LiCl–KCl–Cl_2C was measured. By combining the data of the first cell with that of the last cell, the free energy of formulation of $PuCl_3$ in LiCl–KCl solution was found to be represented by the equation $-\Delta F_T=224-0.046\,T$ (kcal/mole). Author (NSA)

N66-27257# Argonne National Lab., Ill.
CORRECTIONS FOR X-RAY INTENSITY DATA OBTAINED FROM ELECTRON MICROPROBES
Raymond K. Hart Nov. 1965 12 p refs
(Contract W-31-109-ENG-38)
(ANL-7078) CFSTI: HC $1.00/MF $0.50

The chemical composition of a specimen can be determined quantitatively by electron microprobe analysis, providing suitable corrections are applied to the instrumental data. Corrections to be made fall into two groups: instrumental, and those associated with the interaction of electrons and X-rays with the specimen. The nature and application of these corrections to experimental data are discussed.
Author (NSA)

N66-27264# Argonne National Lab., Ill.
PRODUCTION OF PLUTONIUM MONOCARBIDE BY REACTION OF ELEMENTAL PLUTONIUM AND CARBON
William G. Tope Jul. 1965 27 p refs
(Contract W-31-109-ENG-38)
(ANL-6969) CFSTI: HC $2.00/MF $0.50

A production process was developed for forming plutonium carbide by direct reaction of the elements. The process consists of charging plutonium into a graphite crucible liner, vacuum melting, and machining the remaining excess graphite from the produced button. Carbon is controlled by reaction temperature and holding time. A 350-g melt, when cycled between 1610°C and 1660°C for 45 min, will analyze 4.3±0.2 wt.% carbon. Metallographic examination showed a PuC matrix with 10% to 15% Pu_2C_3 appearing as dendrites. An unidentified precipitate exists within the Pu_2C_3 phase. A 1-kg batch, when cycled for 75 min, will analyze near 4.6 wt.% carbon. The 1-kg size batches exhibited the same microstructure as the 350-g-size batches but were less homogeneous. Reacting at a constant temperature gave a carbon-rich core in the carbide button. Typical product impurities were 225 ppM oxygen, 20 ppM nitrogen, and a total near 1000 ppM for other minor-element impurities. Carbon content can be adjusted. A carbon-rich product can be diluted by adding either plutonium or low-carbon stock and remelting in carburized tantalum components. A carbon-poor product can be recharged into a graphite liner and reacted again. Sound castings, 0.9 cm in diameter and greater than 6 cm in length, were made by melting in a tantalum crucible and casting into tantalum-coated graphite sleeve molds.
Author (NSA)

N66-27331# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
EQUILIBRIUM SOLID SOLUTIONS OF NITROGEN IN CB–1% ZR BETWEEN 1200–1800°C
H. Inouye Feb. 1966 16 p refs Presented at the 4th AIME Symp. on Phys. Met. of Refractory Metals, French Lick, Ind., 3–5 Oct. 1965
(Contract W-7405-ENG-26)
(ORNL-TM-1355; CONF-651025-12) CFSTI: HC $1.00/MF $0.50

An ultrahigh vacuum technique capable of measuring sorption rates as low as 4×10^{-3} ppM N/hr and pressures of 10^{-10} torr of nitrogen was used to measure the thermodynamic properties of solutions of nitrogen in Nb–1% Zr between 1200° and 1800°C. In the composition range 31 to 278 ppM N, the solutions obeyed Sievert's law. An anomalous nitrogen in solution occurred between 1200° and 1400°C and was attributed to an oxygen–nitrogen interaction. The partial molar free energy expression for the equilibrium $1/2N_2=N$ in the temperature range 1400° to 1800°C was $\Delta F^0=-51,500+20.74T$, and $\Delta F^0=-34,200+9.52T$ for the temperature range 1200° to 1400°C. Author (NSA)

N66-27333# Oak Ridge National Lab., Tenn. Chemical Technology Div.
PREPARATION OF THORIA AND MIXED-OXIDE MICROSPHERES
Paul A. Haas and S. D. Clinton Nov. 1965 29 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1281) CFSTI: HC $2.00/MF $0.50

A process was developed for preparing thoria, thoria–urania, or other oxide spheres of 50–1000 micron diameter, high strength, and nearly theoretical density. The starting materials were colloidal oxide sols. The sols were dispersed as uniform droplets in an organic liquid by use of two-fluid nozzles or rotary feeders. The drops of sol were suspended and converted to gel spheres in the organic solvent which extracted water at slow, controlled rates. In order to fluidize the sol drops and to avoid coalescence, clustering, and deposition on the wall, the use of surfactants in the solvent and of special vessel configurations were necessary. The gel spheres were separated from the solvent, dried, and calcined to 1150°C. Microspheres were prepared using 2-ethylhexanol as the drying solvent in a continuous column system including solvent recovery. Demonstrated capacities of the system were 5 kg of 240 micron thoria spheres in one day or 700 g/hour for short periods. Thoria-8% urania spheres of 250 to 300 micron diameter had the following properties: particle density, 99.4% of theoretical; krypton BET surface area, 0.003 m^2/g; particle crushing strength, greater than 5.7 kg/particle for 25 particles tested. Author (NSA)

N66-27334# Union Carbide Nuclear Co., Oak Ridge, Tenn. Engineering Development Dept.
ALLOY POWDER PREPARATION BY FLAME REDUCTION TECHNIQUES
S. H. Smiley, D. C. Brater, and H. L. Kaufman [1965] 26 p refs Presented at the Am. Inst. of Mining, Met., and Petrol. Eng. Met. Soc. Meeting, New York
(Contract W-7405-ENG-26)
(K-L-6076; CONF-660205-2) CFSTI: HC $2.00/MF $0.50

The preparation of high purity W–Re powders by the H_2 reduction of the volatile fluorides using a unique flame process is described. The technological and economic potential of a fluoride volatility process for recovering valuable fabrication scrap, out-of-specification flame reduction powder, and other reject materials is discussed in detail. Preliminary estimates of reconversion costs of the hexafluorides to high purity alloy powders are included. NSA

N66-27335# Sandia Corp., Albuquerque, N. Mex. Sandia Corporation Library Scientific Translation Service.
MASS-SPECTROMETRIC DETECTION OF REACTIONS BETWEEN HIGHLY EXCITED HYDROGEN ATOMS AND ETHYLENE MOLECULES [MASS-SPEKTROMETRICHESKOE OBNARUZHENIE REAKTSII VYSOKOVOZBUHDENNYKH ATOMOV VODORODA S MOLEKULAMI ETILENA]

S. E. Kurpianov 10 Jan. 1966 10 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 162, no. 4, 1965 p 865–868
(SC-T-66-0708) CFSTI: HC $1.00/MF $0.50

The results of studies made concerning reactions in ethylene with the participation of highly excited hydrogen atoms are reported. The number of highly excited carbon atoms formed was considerably smaller than the number of hydrogen atoms; therefore their importance in the processes involved is apparently not great. During a rise in pressure on the ethylene, the ion source generates other ions, including $C_2H_4^+$, $C_2H_3^+$, and $C_2H_2^+$. Mechanisms for the formation of these ions are discussed. NSA

N66-27340# Arkansas Univ., Fayetteville.
X-RAY DIFFRACTION STUDIES OF AQUEOUS ALKALI METAL HALIDE SOLUTIONS
Richard Manley Lawrence (Ph.D. Thesis) 1965 136 p refs
(Contract AT(40-1)-2096)
(TID-22527) CFSTI: HC $4.00/MF $1.00

In order to determine the sizes, hydration, and association of alkali metal and halide ions in concentrated aqueous solutions X-ray-diffraction techniques were utilized. Radial distribution functions (RDF's) were derived and interpreted in terms of the sizes and environments of the ions. From the positions of the ion-water peaks in the RDF's the sizes of the aqueous ions were found to be given by their usual crystal radii. The number of primary waters of hydration was relatively independent of the concentration of the solution and appeared to slightly increase with increasing size of the halide ion. NSA

N66-27363# Oak Ridge National Lab., Tenn. Liquid Metals Section.
DETERMINATION OF OXYGEN IN SODIUM BY LIQUID AMMONIA
V. Attas and C. Boudier Mar. 1965 14 p refs Transl. into ENGLISH of Centre d'Etudes Nucl. Rept. no. DRP/ML/FAR-R-160
(ORNL-TR-931)

A method of determining the oxygen content in sodium by dissolving the sodium in liquid ammonia is presented. The apparatus and its mode of operation are described. The method consists in treating the sodium sample with liquid ammonia until all of it has been dissolved. The oxide is then collected and measured. The sodium found in the ammonia is also measured; from these two measurements the oxide to sodium ratio is found and from there the oxygen content. Only a few rough analyses have been carried out, but the results are encouraging. NSA

N66-27384# Oak Ridge National Lab., Tenn.
SYNTHESIS OF 3,9-DIETHYLTRIDECYL-6-AMINE
H. L. Holsopple and F. G. Seeley 5 Nov. 1965 12 p
(Contract W-7405-ENG-26)
(ORNL-TM-1314) CFSTI: HC $1.00/MF $0.50

The preparation of 3,9-diethyltridecyl-6-amine is described. The basic starting materials 3,9-diethyltridecanol-6, was oxidized to the ketone, converted to the oxime, then catalytically hydrogenated to the amine. Purification was by fractional vacuum distillation and ion-exchange sorption of the amine. A description is given of the equipment used in the hydrogenation procedure. The preparation of Raney nickel catalyst is also described. Author (NSA)

N66-27387# Kansas State Univ., Manhattan. Dept. of Chemistry.
LOW ENERGY INVESTIGATIONS OF RADIATION CHEMISTRY Final Report, 1 Feb. 1964–14 May 1965
Robert W. Kiser 15 Nov. 1965 23 p
(Contract AT(11-1)-751)
(TID-22444) CFSTI: HC $1.00/MF $0.50

Developments are reported for studies on: mass spectrometry of organic compounds, transition metals, and organometallics; negative ions, and multiple charged ions; and hot-atom chemistry studies on the $^{59}Co(n,\gamma)^{60}Co$ system with coordination compounds and the $^{32}S(n,p)^{32}P$ systems. NSA

N66-27402# Cornell Univ., Ithaca, N. Y.
THE ELECTRON SPIN RESONANCE IDENTIFICATION OF N_3 IN IRRADIATED SODIUM AZIDE
Edward Golerinter (Ph.D. Thesis) Feb. 1966 69 p refs
(Contracts AT(30-1)-2150; ARPA SD-68)
(NYO-2150-11) CFSTI: HC $3.00/MF $0.75

A radioinduced defect in sodium azide was studied and identified as an N_3^- ion in the azide position. Since the valence electron of the N_3^- ion was in an orbitally degenerate state and the defect was in a site of trigonal symmetry, a Jahn–Teller distortion was expected. ESR spectra are predicted for the cases when the molecular configuration is frozen in one of three static distortions, when tunnelling matrix elements exist between these three distortions and are small compared to the magnetic splittings, and when the tunnelling matrix elements are large compared to the magnetic splittings. The observed data correspond to the first case and a value of 500 cm^{-1} for the Jahn–Teller energy splitting was obtained. Part of the Jahn–Teller distortion consists of a tilt of the internuclear axis of the N_3^- and the amount and direction of this tilt was found from the data. An attempt was made to understand some of the observed hyperfine effects using published data pertaining to N_3^- in potassium azide. NSA

N66-27443# Temple Univ. Research Inst., Philadelphia, Pa.
PLASMA JET CHEMISTRY Final Report, 1 Dec. 1964–1 Dec. 1965
C. S. Stokes and J. A. Cahill Dec. 1965 34 p refs
(Grant AF-AFOSR-775-65)
(RITU-1965-40; AFOSR-66-0607; AD-630549) CFSTI: HC $2.00/MF $0.50

A plasma jet has been used as the source of energy for producing a high temperature medium for purposes of chemical synthesis. The tungsten carbides (WC and W_2C) were formed in a helium plasma jet from either tungsten or tungsten trioxide (WO_3) and methane. Similarly the tantalum carbides (TaC and Ta_2C) were produced from tantalum and tantalum pentoxide (Ta_2O_5) with methane in a like manner. Hydrogen sulfide was successfully synthesized from its elements in a helium plasma jet. TAB

N66-27447# Isotopes, Inc., Westwood, N. J.
FLIGHT DATA AND RESULTS OF RADIOCHEMICAL ANALYSES OF FILTER SAMPLES COLLECTED DURING 1964 Twelfth Progress Report
Herbert W. Feely, Donald C. Bogen, Raymond J. Lagomarsino, John E. Hardaway, and Micah W. M. Leo New York, AEC, 15 Mar. 1966 143 p
(Contract DA-49-146-XZ-079; Proj. Stardust)
(HASL-169) CFSTI: HC $4.00/MF $1.00

Flight data and results of radiochemical analyses of stratospheric and tropospheric air filter samples collected during 1964 in Project Star Dust are tabulated. Methods used are described. The nuclides measured include fission products, products of neutron activation, and naturally occurring radionuclides. NSA

N66-27456# Rocky Flats Div., Dow Chemical Co., Golden, Colo.
THE IMPURITY ANALYSIS OF PLUTONIUM PEROXIDE AND PLUTONIUM FLUORIDE
A. J. Johnson and E. Vejvoda 4 Feb. 1966 12 p refs
(Contract AT(29-1)-1106)
(RFP-599) CFSTI: HC $1.00/MF $0.50

A review was made on the spectrographic methods used for the impurity analysis of plutonium peroxide and plutonium fluoride. For comparison purposes, the impurity analyses on nitrate feeds, peroxides, fluorides, and metal buttons are reported. Author (NSA)

N66-27457# Rocky Flats Div., Dow Chemical Co., Golden, Colo.
CRITICAL TEMPERATURE OF PLUTONIUM-CHLORINATED SOLVENT REACTIONS
S. H. Pitts, Jr. 18 Feb. 1966 10 p ref
(Contract AT(29-1)-1106)
(RFP-688) CFSTI: HC $1.00/MF $0.50

Critical temperatures were determined for some plutonium-chlorinated solvent reactions. The critical temperature is defined as the lowest temperature at which plutonium reacts with the solvent to yield an exothermic reaction accompanied by light emission. These temperatures were determined by heating plutonium samples to a known temperature in argon and dropping them into various solvents while visually watching for a reaction. The solvents used were carbon tetrachloride, trichloroethylene, perchloroethylene, and Freon TB-1. A correlation was established between the critical temperature and surface area for unalloyed and 1 wt.% gallium alloyed plutonium in several chlorinated solvents. The critical temperature decreased as the specific surface area was increased. NSA

N66-27460# Oak Ridge National Lab., Tenn.
ANALYTICAL CHEMISTRY DIVISION Annual Progress Report, Period Ending Nov. 15, 1965
Helen P. Raaen, comp. Jan. 1966 167 p refs
(Contract W-7405-ENG-26)
(ORNL-3889) CFSTI: HC $5.00/MF $1.00

Continuing research and research-associated activities, instrumentation, analytical methods, and service analyses are reported. Among the areas investigated are: absorption spectrophotometric and voltametric studies of molten salts; reactor chemistry; biochemistry; X-ray and spectrochemical analyses; mass, infrared, and nuclear magnetic resonance spectrometry; optical and electron microscopy; and nuclear and radiochemical analysis. N.E.N.

N66-27465# Oak Ridge National Lab., Tenn.
FLOODING IN PERFORATED-PLATE PULSED EXTRACTION COLUMNS: A SURVEY OF REPORTED EXPERIMENTAL DATA AND CORRELATIONS, AND THE PRESENTATION OF NEW CORRELATIONS WITH PHYSICAL PROPERTIES, OPERATING VARIABLES, AND COLUMN GEOMETRY
W. S. Groenier, R. A. Mc Allister, and A. D. Ryon Mar. 1966 312 p refs
(Contract W-7405-ENG-26)
(ORNL-3890) CFSTI: HC $7.00/MF $1.50

All of the readily available flow capacity data for pulsed perforated-plate extraction columns were compiled and correlated with physical properties, mode of operation, and column parameters. About 2200 data points representing over 20 different chemical systems having a wide range of physical properties were used in the correlations for both aqueous- and organic-continuous operation in a variety of columns. Exact equations describing flooding due to insufficient pulsation are presented for 9 different modes of flow control in and out of the column. In each case, the flow capacity is a function only of flow ratio and pulse velocity. Flooding in the emulsion regime, however, is much more complex. Correlations were made by combining the variables of physical properties, pulse, and column geometry in dimensionless groups and determining the coefficients by multiple regression. A number of equations gave nearly equal success. Using the best equation, the calculated flow capacity is, on the average, 8.6% higher than experimental, with a standard deviation of 45. The new correlations were compared to several in the literature which had been derived from a much narrower range of the variables. Author (NSA)

N66-27470# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Obninsk (USSR). Fiziko-Energeticheskii Institut.
STATE OF CESIUM IMPURITIES UTILIZED IN THERMIONIC CONVERTERS [SOSTOYANIE PRIMESEI V TSEZII, ISPOL'ZUEMOM V TERMOIONNOM PREOBRAZOVATELE]
V. I. Subbotin, M. N. Ivanovskii, M. N. Arnol'dov 1965 7 p refs In RUSSIAN
(FEI-22)

Under approach-to-equilibrium conditions in the thermionic converter, oxygen is present in the form of oxides of the elements in the materials from which the cold electrode is made. At complete equilibrium, oxygen is present as the oxide and hydroxide of the cesium in the reservoir and hydrogen as cesium hydroxide and free hydrogen. This is because the cesium in the reservoir, kept at 300°C to maintain 1 mm Hg pressure, contains CsOH, Cs_2O, and CsH from reaction with air. Dissociation of these compounds to release hydrogen and oxygen, plus some water, is not a significant source of impurities in the vapor; the cesium and cesium oxide in the reservoir actually acts as a getter. The vapor in the hot part of the converter, at 1500°–2000°C, contains molybdenum, and that in the cold part, at 500°–1000°C, contains niobium and stainless steel components. In the molybdenum electrode zone MoO_2 is formed but goes to the volatile MoO_3 which is reduced by the other materials on the "cold" electrode (e.g., Ni, Ti, Fe, Cr). Any free hydrogen or water in the vapor also reduces the molybdenum oxides. NSA

N66-27471# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
STUDY OF THE DIFFUSION OF IRON, OF SILVER AND OF CARBON IN BERYLLIUM USING RADIOACTIVE TRACERS [ETUDE DE LA DIFFUSION DU FER, DE L'ARGENT ET DU CARBONE DANS LE BERYLLIUM AU MOYEN DES TRACEURS RADIOACTIFS]
Mool Chandra Naik (M.S. Thesis—Paris Univ.) 1965 50 p refs In FRENCH
(CEA-R-2621)

A study was made on the diffusion of radioactive iron and silver tracers in beryllium. The following values were found: $D_{Fe}=0.53\ \exp-(51{,}800/RT)$, $D_{Ag}=6.2\ \exp-(46{,}100/RT)$. A comparison of the diffusion coefficients for iron, silver, and nickel showed that the diffusion rate increased with increasing solute atom radius. The existence of diffusion

anisotropy for silver was indicated and studied quantitatively on monocrystals. The anisotropy decreased as the temperature increased. The silver diffused more rapidly along the C axis than in the base plane. This result cannot be explained in terms of the model proposed for the diffusion of foreign atoms in solution in zinc. A greater number of experiments is required before a model can be put forward. An attempt was made to determine the diffusion coefficients of carbon in beryllium by treatment in an atmosphere of acetylene marked with C-14. Diffusion coefficients were obtained but these should not be considered to be significant since a chemical reaction occurred at the surface of the samples.
NSA

N66-27507# Argonne National Lab., Ill.
THE MASS TRANSFER OF SINGLE, SOLID URANIUM SPHERES TO FLOWING MOLTEN CADMIUM IN LAMINAR AND TURBULENT FLOW
E. Dean Traylor Sep. 1965 166 p refs
(Contract W-31-109-ENG-38)
(ANL-7091) CFSTI: HC $5.00/MF $1.00

A 1/2-in. dia U sphere was used and molten Cd was pumped past the test spheres at different flow rates. Mass transfer coefficients were determined from weight losses of the test spheres. The Cd–U system was chosen because it was possible to operate in a temperature range in which U was the solid phase in equilibrium with the molten Cd solution. The J_d data and other derived correlations were compared with previous correlations and data for different systems. The experimental curves for mass transfer have the same general shape as those found previously by Geankoplis and Steele for the mass transfer from 2-naphthol, benzoic acid, and cinnamic acid in water. An exception to this similarity is that a pronounced hump in the J_d factor vs Reynolds number correlation occurs in the region where turbulence penetrates to the surface of the sphere, and associated pressure changes occur in the vicinity of the sphere. The driving force for mass transfer was varied and the mass fluxes were obtained and plotted vs the concentration and activity driving forces. Extrapolation of these curves to zero driving force yielded finite mass flux rates that were different from the zero value expected at the saturated condition. It was shown that neither attrition nor the activity data and activity driving force could account for the finite flux at zero driving force. U spheres that were heat-treated showed random grain structures and yielded J_d values about 2 to 5 times higher than spheres not heat-treated to give nonrandom structures. The skin friction, f/2, for spheres in organic liquids from Reynolds numbers of 10^2 to 10^3 and at a separate Reynolds number of 1.56×10^5 was 2 to 3 times greater than the J_d for U–Cd. The results of runs with artificially roughened spheres showed that the roughening produced no effect at a Reynolds number of 330. At a Reynolds number of 8.8×10^3 the J_d for the roughened sphere was about 80% higher than for the smooth sphere. This could be attributed to the early onset of the tripping of the boundary layer. The exponent of the Schmidt number was determined at Reynolds numbers of 735 and 115 to be approximately 0.60. However, the range of variation of the Schmidt number was only 60%.
NSA

N66-27511# Atomic Energy Commission, New Brunswick, N. J.
EVALUATION OF THE METHODS IN TID-7029, "SELECTED MEASUREMENT METHODS FOR PLUTONIUM AND URANIUM IN THE NUCLEAR FUEL CYCLE"
M. W. Lerner 15 Feb. 1966 132 p
(NBL-231) CFSTI: HC $4.00/MF $1.00

A compilation and statistical analysis of the results of analyses for Pu and U in standardized materials by different laboratories using the methods contained in TID-7029 is presented.
NSA

N66-27513# Oak Ridge National Lab., Tenn. Research Materials Information Center.
LISTS OF AVAILABLE AND DESIRED MATERIALS (ULTRAPURE INORGANIC RESEARCH MATERIALS)
T. F. Connolly Aug. 1965 29 p
(Contract W-7405-ENG-26)
(ORNL-RMIC-4) Available from Oak Ridge Natl. Lab., Tenn.

Two lists are included: high-purity inorganic solid-state research materials known to be available (or at least to have been produced); and materials about which information has been requested from the RMIC and for which no source could be found. Although only the highest purity and largest size is given for each material, it should be assumed that for many of the materials shown, lower purities and other forms are probably available. All entries are single crystal unless otherwise specified.
NSA

N66-27518# Atomic Energy Commission, Oak Ridge, Tenn. Div. of Technical Information Extension.
SUMMARIES OF THE USAEC BASIC RESEARCH PROGRAM IN CHEMISTRY (OFF SITE)
Jan. 1966 158 p refs
(TID-4005, Pt. 2a, 2nd Ed.) CFSTI: HC $1.75/MF $1.00

Approximately 200 summaries are given of individual research projects supported by the Office of Chemistry Programs of the Division of Research under its offsite program. Attempts were made to include summaries for all contracts in effect on Dec. 1, 1965. The contract summaries are arranged in alphabetical order by contractor. Subject and author indexes are included. Each summary includes the name and address of the principal investigator, AEC contract number, and the date on which the summary was received.
NSA

N66-27523# Pitkin (Lucius), Inc., Grand Junction, Colo.
HANDBOOK OF ANALYTICAL PROCEDURES
W. E. Bush and L. J. Higgins, comp. 17 Jun. 1965 95 p refs
Suppl. to RMO-3001, Rev. no. 1
(Contract AT(05-1)-912)
(RMO-3001, Rev. 1, Suppl.) CFSTI: HC $3.00/MF $0.75

Methods are described for: determination of major and minor constituents of silicate rocks and ores; water analysis; radiochemical analysis; and determination of uranium in various media.
NSA

N66-27524# Isotopes, Inc., Westwood, N. J.
FLIGHT DATA AND RESULTS OF RADIOCHEMICAL ANALYSES OF FILTER SAMPLES COLLECTED DURING 1963 UNDER PROJECT STARDUST Appendix to Eleventh Progress Report
Herbert W. Feely, James P. Friend, Raymond J. Lagomarsino, Donald C. Bogen, Pierre E. Biscaye et al New York, AEC, 15 Mar. 1966 233 p
(Contract DA-49-146-XZ-079)
(HASL-168) CFSTI: HC $6.00/MF $1.25

Flight data and results of radiochemical analyses of stratospheric and tropospheric air filter samples collected

during 1963 in Project Star Dust are tabulated. The methods used are described. The nuclides measured include fission products, products of neutron activation, and naturally occurring radionuclides. NSA

N66-27547# Brookhaven National Lab., Upton, N. Y.
CHARACTERIZATION STUDIES FOR POLYETHYLENE FORMED BY Co^{60} GAMMA RADIATION UNDER CONSTANT CONDITIONS IN A NON-FLOW SYSTEM
P. Colombo, J. Fontana, L. E. Kukacka, and M. Steinberg Mar. 1965 34 p
(Contract AT(30-2)-GEN-16)
(BNL-9043) CFSTI: HC $2.00/MF $0.50

The yield and rate of polymerization of ethylene by ^{60}Co gamma radiation in a non-flow system have been described in BNL Report 8801. The polyethylene formed over the wide range of conditions reported in BNL 8801 was evaluated and a description of some of the properties are given. The reaction vessel used for the above experiments is of 316 stainless steel and had an internal volume of 100 cc. The bottom assembly contains a thermocouple well for measuring reaction temperature and the upper assembly contains a rupture disc and a closure valve. Another series of experiments were carried out in an elongated or "fallthough" vessel. This type of reaction vessel has an internal volume of 420 cc and a length of 30 in. The low part of the vessel was inserted into a lead shielding cask so that only the top 6 in. (120 cc volume) is subjected to radiation. The purpose of the elongated vessel was to alloy the polymer to fall out of the radiation field as it is formed. Polymer characterization data are presented for experiments conducted in the 100 cc capsule reaction vessel and for experiments performed in the elongated vessel. All radiations were conducted in the water tank-type facility in the High Pressure Gamma Laboratory. NSA

N66-27552# Michigan State Univ., East Lansing. Dept. of Chemistry
CORRELATED EPR-OPTICAL SPECTRA OF POTASSIUM IN ETHYLAMINE-AMMONIA MIXTURES
L. R. Dalton, J. D. Rynbrandt, E. M. Hansen, and J. L. Dye [1965] 64 p refs
(Contract AT(11-1)-958)
(COO-958-5; CONF-650401-16) CFSTI: HC $3.00/MF $0.75

Extensive electron paramagnetic resonance (EPR) studies of potassium in ethylamine-ammonia mixtures were made over a temperature range of −180°C to +100°C and at varying ammonia concentrations up to 68 mole percent. Hyperfine splittings, g values, linewidths, and spin concentrations were measured. Optical spectra were measured from −65°C to +35°C for a number of the solutions. Correlation of optical and EPR results rules out the assignment of the visible absorption to the monomeric species responsible for hyperfine splitting. The unusual temperature dependence of the EPR spectra cannot be explained in the light of current models, nor can the ammonia dependence be quantitatively interpreted. A model involving equilibrium between atoms and monomers quantitatively describes the temperature dependence. To explain the dependence upon ammonia concentration, it is necessary to consider two monomeric species, one fully solvated by ethylamine and the other involving replacement of ethylamine by one molecule or ammonia. Above about eight mole percent ammonia, computer analysis of the EPR spectra showed the building-in of an extra absorption consisting of a single broad line. The intensity of this absorption relative to the four-line pattern continued to increase until the lines merged at about 25 mole percent ammonia. Under varying conditions, the optical spectra showed the three peaks characteristics of metal-amine solutions. Relative intensities were very sensitive to temperature and ammonia concentration. At low ammonia concentrations, only the visible absorption was obtained while the intermediate and infrared absorptions occurred at higher concentrations. The latter two peaks were favored by high temperature, while the visible absorption was more pronounced at lower temperatures. These spectra are discussed in the light of current models for metal-amine solutions. Author (NSA)

N66-27555# Argentina. Comision Nacional de Energia Atomica, Buenos Aires.
PREPARATIVE CHROMATOGRAPH OF MOVING-GAS PHASES [CHROMATOGRAFO PREPARATIVO DE FASE MOVIL GASEOSA]
Rustam T. Bonard and Gerardo J. Videla 1965 14 p In SPANISH Presented at 11th Argentina Chem. Conf., Bahia Blanca, Argentina, Nov. 1964 *Its* Rept.-140
(CONF-641123-1)

The basic characteristics of a gas chromatograph design for the preparation of substances to be used in organic synthesis, especially of compounds labelled with radioisotopes, in the production of carriers of a suitable purity of infrared and mass spectrometry, and in gaseous chromatography were described. In the construction, the derivative problems of preparative chromatography were taken into consideration with emphasis on the fast injection and vaporization of large quantities of the sample and the recovery of the fractions separated. This apparatus is simple in construction and operation and resolves economically problems of preparative gaseous chromatography with an efficiency comparable to more elaborate commercial instruments. NSA

N66-27557# Louvain Univ. (Belgium). Inst. of Agronomy
THERMODYNAMICS AND THERMOCHEMISTRY OF EXCHANGES BETWEEN THE BARIUM ION AND THE ALKALINE CATIONS IN CLAYS [THERMODYNAMIQUE ET THERMOCHIMIE DES ECHANGES ENTRE L'ION BARYUM ET LES CATIONS ALCALINS DANS LES ARGILES] Final Report
R. Van Bladel and H. Laudelout Jun. 1965 52 p refs In FRENCH
(Contract IAEA-171/RB)
(NP-15353)

The thermodynamic functions corresponding to the exchange $2NH_4$ zeolite(Z)+$BaCl_2$⇌Z Ba Z+$2NH_4Cl$ were established from the exchange isotherms between an exchanger (Camp Berteau Montmorillonite) saturated with ammonia and a mixed solution of electrolytes (ammonium chloride and barium chloride) with constant total normality for a test but with variable ratio of the normalities of the two cations. The results were completed by a study of the reaction 2 Na Z+$BaCl_2$⇌Ba Z+2NaCl in which the standard variation of the thermodynamic potential and the exchange enthalpy were determined by the same methods indicated. Calculation of the partial molar magnitudes and of the thermodynamic functions of relative excess with these exchanges are discussed. NSA

N66-27559# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
RESEARCH AND DEVELOPMENT ACTIVITIES, FIXATION OF RADIOACTIVE RESIDUES Quarterly Progress Report, Apr.–Jun. 1965
A. M. Platt, ed. 9 Nov. 1965 36 p
(Contract AT(45-1)-1830)
(BNWL-139) CFSTI: HC $2.00/MF $0.50

Samples of phosphate glass produced from Purex waste in the Hot Cell Glass Experiment did not show appreciable change in leachability over a seven-month period since they were made. However, they are showing evidence of separation of a minute second phase. Laboratory studies of glass formulations indicated that the properties of the glass are affected by the precious metal and fission product contents of the glasses. Flowsheet development with simulated NFS 1st and 2nd cycle waste and added phosphoric acid was completed with a successful 40-hr spray calciner run. Metallic cation equivalent to phosphorus atom ratio (M^{+}/P) equal to 3.1 was the most successful composition. A feed composed of a sulfate-bearing condensate adjusted to melt with caustic was not operable in the spray calciner-melter. Other tests included successful thermal shock cleaning of the calciner wall, an acceptable air vibrator to replace an air hammer, and wire filters. Design verification testing of the pot calciner prototype and its related WSEP hardware was successfully completed. Preliminary fission product release tests were made with 15 g samples of simulated waste material spiked with ^{137}Cs. Release fractions of up to one percent were observed during one hour at temperatures up to 1200°C. The reaction between the molten waste material and the stainless steel containers was briefly studied. Temperatures at Purex waste tanks in infinite arrays with 120-foot center-to-center tank pacings were compared with those for single tanks with no neighbors. A recycle flowsheet to improve cesium product purity was demonstrated. Nominal Na/Cs ratios of 8/1 were reduced to 1/3.4 by use of recycle and increased scrub volumes. NSA

N66-27594# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
USE OF COARSE POROUS GLASS IN GAS-ADSORPTION CHROMATOGRAPHY FOR THE SEPARATION OF LIQUID HYDROCARBONS
S. P. Zhdanov, A. V. Kiselev, and Ya. I. Yashin 21 Jan. 1966 18 p refs Transl. into ENGLISH from Neftekhimiya (USSR), v. 3, no. 3, 1963 p 417–424
(FTD-TT-65-1487/1+2; TT-66-60988; AD-630970) CFSTI: HC $1.60/MF $0.50

The possibility is pointed out of using coarse porous glass for the separation of normal alkanes and aromatic hydrocarbons with boiling temperatures up to 150°C by the method of gas-adsorption chromatography. A study of the dependence of the effectiveness of the column with coarse porous glass on the linear speed of the gas-carrier indicated the possible use of such columns at great linear speeds. From the chromatograms taken at various temperatures, the adsorption heats of a series of hydrocarbons on the hydroxylated surface of silicon were determined. The adsorption heats of normal alkanes and normal alkyl benzenes increase linearly with the increase in the number of carbon atoms in the molecule. The adsorption heat of ethylene is greater than that of benzene, and that of alkyl benzene is greater than the corresponding n-alkanes because of the specific interaction, primarily, of the pi-electron bonds with the hydroxyl groups of the surface. The values determined from the chromatograms of heat adsorption were close to those obtained calorimetrically. Author (TAB)

N66-27614# Tennessee Univ., Knoxville. Dept. of Physics.
AN INVESTIGATION OF THE EFFECT OF MULTIPLE ABSORPTION AND EMISSION OF RESONANCE-LINE PHOTONS ON LINE SHAPE AND LINE INTENSITY Scientific Report No. 2
Gene W. Ray, William E. Deeds, and Alvin H. Nielsen Feb. 1966 137 p refs
(Contract AF 19(628)-4323; Grants NSF G-13581; NSF GP-4046)
(AFCRL-66-96; AD-631798) CFSTI: HC $4.00/MF $1.00

The purpose of the study was to investigate the effect of multiple absorption and emission of resonance-line photons on pressure-broadened line shapes and intensities and to determine if this effect could explain the experimentally observed deviations from Lorentz theory. A Monte-Carlo method was used to follow photons step by step through an absorption cell. The effect of multiple scattering on line intensities was determined over a wide range of cell geometries and maximum absorption coefficients and was found to be over 10% for the usual experimental conditions. Line shapes were calculated for several HF rotation-vibration lines; with the actual parameter values and cell geometries used in an experimental study. Comparison with the observed line shapes indicates that multiple scattering certainly accounts for some of the observed deviations from Lorentz shape. Also, it was found that experimentally determined half-widths and maximum absorption coefficients can be seriously in error. Author (TAB)

N66-27631# Stauffer Chemical Co., Weston, Mich.
RESEARCH ON SYNTHESIS AND CHARACTERIZATION OF HIGHLY ARYLATED SILICON ORGANIC COMPOUNDS Final Report, 1 Jun. 1964–15 Jul. 1965
G. M. Hart, G. J. Sterken, R. L. Borton, and S. J. Veselka Wright-Patterson AFB, Ohio, ARL, Jan. 1966 47 p refs
(Contract AF 33(615)-1802)
(ARL-66-0005; AD-631673) CFSTI: HC $2.00/MF $0.50

Seven sterically hindered tri-aryl, alkylaryl and trialkyl silicon monomers were prepared, six of which contained a single Si–F bond and one of which contained a single Si–H bond. The compounds were prepared according to the following general procedure: (1) $R\ MgX + SiF_4 \rightarrow R\ SiF_3 + MgFX$, (2) $R\ MgX + R\ SiF_3 \rightarrow R_2SiF_2 + MgFX$, (where RMgX = 1-naphthyl magnesium bromide, cyclohexyl magnesium chloride and benzyl magnesium chloride), (3) ArLi or $R\ MgX + R_2SiF_2 \rightarrow ArSi\ (R_2)\ F$ or R_3SiF, (where ArLi = 4-bromophenyl-lithium and 4[4'-bromobiphenylyl]-lithium and R MgX is cyclohexyl magnesium chloride). The direct controlled catalytic bromination of benzyl trifluorosilane was successfully carried out in the preparation of the p-bromobenzyl derivative, as was the reduction of tricyclohexylfluorosilane by diisobutyl aluminum hydride in the preparation of tricyclohexyl-silane. Author (TAB)

N66-27652# Research Triangle Inst., Durham, N. C.
PHOTOCHEMISTRY OF 2-ALKYLAMINOPHENOXAZ-3-ONES. II
M. C. Wani and Samuel G. Levine [1966] 19 p ref
(Contract DA-31-124-ARO(D)-169; Grant DA-ARO(D)-31-124-G250)
(AROD-3418-3; AD-631366) CFSTI: HC $1.60/MF $0.50

The photochemistry of 2-dialkylaminophenoxaz-3-ones was investigated. In general these compounds were found to be more photo-reactive than the corresponding monoalkylaminophenoxaz-3-ones. The 2-dimethylaminophenoxaz-3-one underwent photochemical demethylation. Irradiation of the 2-polymethyleneiminophenoxaz-3-ones gave different products depending upon the size of the polymethyleneimine ring. Propyl-, pentyl-, and hexyl-methyleneimine phenoxazones gave novel pentacyclic dicarbomethoxy dimethyl alkyleneoxazolino phenoxazines. Stable dihydrophenoxaz-3-ones were obtained by the reduction of butyl-, pentyl-, and hexyl-methyleneimine phenoxazones. TAB

N66-27666# Tennessee Univ., Knoxville. Dept. of Physics.
THE ν_2 FUNDAMENTAL VIBRATION-ROTATION BAND OF T_2O Scientific Report No. 1
Raymond A. Carpenter (Ph.D. Thesis), Norman M. Gailar, and Alvin H. Nielsen Jul. 1965 93 p refs
(Contract AF 19(628)-4323)
(AFCRL-65-508; AD-631785) CFSTI: HC $3.00/MF $0.75

The ν_2 fundamental vibration-rotation band of the ditritium oxide vapor spectrum was measured by means of a prism-grating spectrometer. An analysis of the rotational structure was carried out. The band center and the values of the rotational constants A, B, and C for the ground state and excited state, consistent with the data for J through six, and consistent with extrapolations from water and dideuterium oxide, were determined. They are ν_0=995.37/cm., A(O)= 11.301/cm., B(O)=4.837/cm., C(O)=3.344/cm., A(V)= 11.982/cm., B(V)=4.868/cm., and C(V)=3.316/cm.
Author (TAB)

N66-27767# MSA Research Corp., Callery, Pa.
DEVELOPMENT OF TECHNIQUES FOR MEASUREMENT OF IMPURITIES IN SODIUM Quarterly Progress Report, Oct.-Dec. 1965
S. J. Rodgers and R. C. Andrews 20 Jan. 1966 16 p refs
(Contract AT(11-1)-765)
(MSAR-66-10) CFSTI: HC $1.00/MF $0.50

Developments in laboratory methods for the determination of impurities in sodium are reported. The methods include: surface tension; organic solvent extraction; and mass spectrometry during high-temperature refluxing. Preliminary measurements with the surface tension method were made on potassium. A difference in surface tension between pure potassium and oxygen-contaminated potassium was noted. In other experiments, high-purity sodium samples were run using naphthalene as a reactant and tetrahydrofuran as a solvent medium and diluent. The high-vacuum reflux distillation unit and the mass spectrometer connection are illustrated. NSA

N66-27770# Atomic Weapons Research Establishment, Aldermaston (England).
THE PERMEATION AND DIFFUSION OF HYDROGEN IN MOLYBDENUM
P. M. S. Jones, R. Gibson, and J. A. Evans Feb. 1966 14 p refs
(AWRE-O-16/66) HMSO: 2s 6d

Permeation and diffusion constants are determined for H_2 in Mo: P=0.17 exp (−19200/RT) std ml s^{-1} $atm^{-0.5}$ cm^2 mm^{-1}, D+7.6×10^{-5} exp (−8400/RT) cm^2 s^{-1}, and the solubility constant is calculated: S=220 exp (−10800/RT) std ml cc^{-1} $atm^{-0.5}$. The solution of H_2 in Mo is more endothermic than other systems for which the heat of solution is known. Author (NSA)

N66-27782# Boston Univ., Mass.
STUDIES OF THE RADIATION CHEMISTRY OF ORGANIC COMPOUNDS Progress Report 1 Feb. 1965-31 Jan. 1966
Norman L. Lichtin 21 Feb. 1966 11 p refs
(Contract AT(30-1)-2383)
(NYO-2383-15) CFSTI: HC $1.00/MF $0.50

Developments are reported for studies on: effects of acid on gamma radiolysis of deaerated methanol; radiolytic *trans-cis* isomerization of stilbene in methanol solution; effects of acid on G(H_2O_2) and G(CH_2O) from the ^{60}Co-gamma radiolysis of aerated methanol; absorption spectrum of methanol before and after gamma radiolysis; and photolysis of methanolic H_2O_2. NSA

N66-27783# United Kingdom Atomic Energy Authority, Wantage (England). Isotope Research Div.
IRRADIATION OF THE CARBON DIOXIDE–METHANE SYSTEM: THE FORMATION OF FORMALDEHYDE
J. A. Hearne Sep. 1965 14 p refs
(AERE-R-5051) HMSO: 2s 6d

Carbon dioxide containing 1000 ppM of methane-^{14}C was irradiated with 4 MeV electrons and the yield of formaldehyde-^{14}C determined by liquid scintillation counting of the dimedone drivative. Temperatures were varied from 25° to 400°C, and some experiments were performed with unlabeled methane and the products analyzed for methanol. Initial G values for formaldehyde were in the range 1–6 molecules/100 eV. Addition of 1% CO reduced G(CH_2O). Equilibrium CH_2O concentrations at high doses were about 2 ppM. No methanol was detected. Consideration of mechanisms involving CH_3 and CH_2 radicals indicate that reactions of the latter are largely responsible for CH_2O formation.
Author (NSA)

N66-27786# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
CONSIDERATIONS OF THE STRENGTH OF SNOW
G. E. H. Ballard and E. D. Feldt Dec. 1965 18 p refs
(CRREL-RR-184; AD-631000)

A mathematical model is presented for the number and size of bonds intersected by a potential failure surface which is age hardening at a constant porosity. NSA

N66-27808# Naval Research Lab., Washington, D. C.
PROCEDURES FOR THE CHEMICAL ANALYSIS OF COPPER-BASE ALLOYS Final Report
O. R. Gates and O. Mylting 10 Mar. 1966 15 p refs
(NRL-6357; AD-631067) CFSTI: HC $1.00/MF $0.50

Two sets of sequence procedures are presented, each with its own recommended application, that will quickly resolve a great number of analytical problems that may be encountered in the chemical characterization of many common and unusual copper-base alloys. One procedure provides for the precipitation of tin, as metastannic acid, with nitric acid when alloy compositions are such that no appreciable tin-contamination problems arise; the second provides for the retention of tin in solution with hydrofluoric acid when tin-contamination problems are present. By the use of the appropriate procedure, rapid access to the greatest possible amount of analytical information on individual samples, and results comparable in accuracy to standard methods, will be obtained. Author (TAB)

N66-27873# Florida Univ., Gainesville. Dept. of Chemistry.
A NEW, HIGH SENSITIVITY GAS CHROMATOGRAPHIC DETECTOR WITH RESPONSE BASED ON DIELECTRIC PROPERTIES OF CONSTITUENTS Final Scientific Report, 1 Sep. 1964–28 Feb. 1966
James D. Winefordner [1966] 4 p
(Contract AF-AFOSR-739-65)
(AFOSR-66-0609; AD-630678) CFSTI: HC $1.00/MF $0.50

A detector was developed consisting of 2 Clapp oscillators that were beat, by a diode mixer circuit, to give a difference frequency that was measured by use of a frequency meter and a recorder. The tank circuit of the sample oscillator contained a cylindrical condenser through which the carrier and sample gases passed; the reference oscillator had a variable air capacitor in the tank circuit. The response of this detector was several orders of magnitude greater than would be predicted for an ideal dielectric constant recorder. The same circuitry could be used for either an RF or a dielectric constant detector, i.e., if a high Q tank coil and a capacitor with closely spaced plates were used, an RF detector resulted, but if the tank were of lower Q and the capacitor had wider plate spacing or large plate area, a dielectric constant resulted. A study was then undertaken to optimize experimental parameters. For most molecules, the limiting detectable sample size is about 10^{10} g/sec, and the range of sample sizes over which near linearity of response occurs is about 1000-fold for non-organic gases. TAB

N66-27881# Tulane Univ., New Orleans, La.
PHYSICAL AND PREPARATIVE STUDIES OF MOLYBDENUM AND TUNGSTEN COMPLEXES Scientific Interim Report, Dec. 1964–Nov. 1965
Ronald D. Archer Wright-Patterson AFB, Ohio. ARL, Jan. 1966 27 p refs
(Contract AF 33(615)-1043)
(ARL-66-0015; AD-631398) CFSTI: HC $2.60/MF $0.50

Several new molybdenum complexes containing chelated 8-hydroxy-quinolinato ligands, including $[MoCl(C_5H_5N)(C_9H_6NO)_2]$ and $[MoCl_2(C_5H_5N)_2(C_9H_6NO)]$ and three oxo-molybdenum(V) derivatives were prepared and studied. A cationic molybdenum(III) species containing chelated ethylenediamine and a cationic tungsten(IV) species containing chelated 2,2'-bipyridine were also synthesized. Other preparative studies included photochemical investigations with tungsten(IV). The complex formerly designated as $K_2MoCl_5H_2O$ by other workers was shown to have less than enough potassium for such a formula, the spectra of K_3MoCl_6 as currently in the literature has been shown to be incorrect, and the apparent discrepancy in the literature concerning the tetrazole complex $Fe(C_2F_3N_4)_2 \cdot 2H_2O$ was explained. Author (TAB)

N66-27882 Army Electronics Labs., Fort Monmouth, N. J.
PREPARATION OF CHEMICAL VAPOR-DEPOSITED MATERIALS FOR USE IN FIELD-ENHANCED ELECTRON EMISSION STUDIES
David G. McMaster Mar. 1966 44 p refs
(ECOM-2681; AD-631515) CFSTI: HC $2.00/MF $0.50

The general principles of chemical vapor deposition (CVD) are described and specific experimental results on the deposition of pyrolytic graphite, of CVD boron nitride, and of CVD tungsten on tungsten substrates are discussed. In order to obtain uniform anisotropic, thin films of pyrolytic graphite and CVD boron nitride, the deposition parameters such as deposition temperature, concentration of the gaseous reactants, and gas flow pattern were varied, and their influence on the deposits was studied. It was found that the uniformity of pyrolytic graphite can be increased by using high total gas flow rates and low methane concentrations. The most uniform CVD-boron nitride deposits were obtained under the following conditions: temperature: 1600°C; gas flow rate (cc/min): ammonia 10, boron trichloride 6, nitrogen 4. The deposits of pyrolytic graphite and CVD boron nitride were successfully degree of anisotropy, thin-film sandwich structures of pyrolytic graphite and CVD boron nitride were successfully produced. Preliminary tests have been performed with CVD tungsten. Author (TAB)

N66-27884# Colorado Univ., Boulder.
HALOGENOID COMPLEXES Final Report
Raymond N. Keller Apr. 1966 10 p refs
(Grant DA-ARO(D)-31-124-G198)
(AROD-3292-5; AD-631282) CFSTI: HC $1.00/MF $0.50

A summary is given of work involving the chemistry of the following halogenoid or pseudo-halide ions: azide (N_3^-), selenocyanate ($SeCN_3^-$), azidodithiocarbonate ($SCSN_3^-$), and cyanate (NCO^-). The emphasis of the research was to determine to what extent the pseudo-halide ions could act as ligands in coordination complexes and the general nature of the resulting compounds. Dissociation constants were obtained for the acids HCN, HN_3, HOCN, HSCN, and HSeCN. Author (TAB)

N66-27886# Navy Dept., Washington, D. C.
CERTAIN FACTORS DETERMINING THE FORMATION OF CHEMICAL BONDS ON THE BORDER OF ADHESIVE COMPOUND AND SUBSTRATE. [O NEKOTORYKH FAKTORAKH, OPREDELYAYUSHCHIKH VOZNIKNOVENIYE KHIMICHESKIKH SVYAZEY NA GRANITSE RAZDELA ADGEZIV-SUBSTRAT]
I. L. Shmurak et al 1966 7 p refs Transl. into ENGLISH from Kauchuk i Rezina (Moscow), v. 24, no. 9, 1965 p 23–26 *Its* Transl.-2129
(TT-66-60933; AD-630744) CFSTI: HC $1.00/MF $0.50

High adhesive strength in polymer systems can be achieved by interpolymerization on the adhesive–substrate interface through the interaction of functional groups of polymers of the adhesive and substrate. The realization of onium interpolymerization, taking place at a low energy of variations and not resulting in the separation of side products on the interface of the adhesive–substrate, made it possible to increase substantially the adhesive strength in a rubber cord system. Author (TAB)

N66-27893# National Research Corp., Cambridge, Mass. Norton Exploratory Research Div.
THERMOCHEMISTRY OF SELECTED COMPOUNDS Quarterly Letter Report, Nov. 15, 1965–Feb. 15, 1966
Ludwig G. Fasolino 15 Mar. 1966 6 p
(Contract Nonr-3608(00))
(AD-631265) CFSTI: HC $1.10/MF $0.50

Several runs of the 2°C hydrolysis of aluminum borohydride with water vapor were performed. The data obtained was more scattered than desirable (ΔH reaction = −227 ± 7 kcal/mole). Indications suggest that the distillation and fractionation temperatures employed in sample preparation may influence this scatter. This is being studied as a variable. This heat data would yield a value of −28 kcal/mole for the heat of formation of aluminum borhydride. Author (TAB)

N66-27895# IIT Research Inst., Chicago, Ill. Technology Center.

DETECTION AND IDENTIFICATION OF CHEMICAL SIGNATURES Final Report, 15 Sep. 1964–14 Sep. 1965

B. K. Krotoszynski and Andrew Dravnieks 12 Oct. 1965 81 p refs

(Contract DA-11-022-AMC-1775(X))

(IITRI-U6012-4; AD-628584) CFSTI: HC $3.00/MF $0.75

The investigation was initiated to study human airborne chemical signatures. A novel apparatus was designed and constructed with inner surfaces of glass and Teflon to permit close control of experimental environment and to monitor humidity and oxygen content. An efficient signature collection system was developed, and techniques of sample acquisition and gas chromatographic analysis were established. The results of signature collection experiments performed on selected human subjects revealed several important features. Seven signature components were found to be common to white, Negro, and Indian males and a white female. It is probable that ethanol, butanol, acetone, and pyruvic and lactic acids are among the common components. Other compounds were found to be common to selected pairs of subjects compared. Some components were characteristic only of a certain individual among those studied and either do not occur in others or exist below the detection limits. Chemical signatures from the same white male individual obtained 14 days apart exhibited large similarities. Less significant similarities were observed between the latter signatures and those from other subjects. Author (TAB)

N66-27909# National Lead Co. of Ohio, Cincinnati. Feed Materials Production Center

[THORIUM, URANIUM AND STAINLESS STEEL METALLURGY RESEARCH] A Summary Technical Report, 1 Oct.–31 Dec. 1965

R. Burgett, ed. Feb. 1966 95 p refs

(Contract AT(30-1)-1156) CFSTI: HC $3.00/MF $0.75

Techniques were developed for purifying various thorium bearing residues by a liquid–liquid extraction process using DAAP as the primary extractant. A second extraction step using TBP was developed for use when the feed material is contaminated by uranium. Uranium derby quality was improved by use of reduction furnaces having three resistance heating elements instead of only two. Electrolytic magnesium was shown to produce uranium metal of satisfactory yields and of quality comparable with that of ferrosilicon-process magnesium. Two-thousand pound ingots were cast to determine the feasibility of controlling the melting cycle of NPR furnaces with infrared radiation pyrometers sighted on the crucible pour slug. Thermoelectric cooling of the carbide tools to machine uranium was found to be ineffective. The corrosion rate of type-304L stainless steel in nitric acid solutions containing fluorides was inhibited by the addition of Fe^{+3}, Al^{+3}, and Th^{+4} ions. To determine the isotropic concentration of U^{235} in uranium residues, the 184 kev gamma ray emitted by U^{235} was measured after U^{238} decay products were removed. Two methods were developed for determining the beta activity of plane effluents containing uranium and thorium decay products.

R.N.A.

N66-27912# National Lead Co. of Ohio, Cincinnati. Technical Div.

THE EFFECTS OF VARIOUS GRADES OF GRAPHITE ELECTRODES ON THE CARRIER DISTILLATION OF IMPURITIES IN U_3O_8: POCO EP-192, EP-192C, AND EP-1924 AND GENERAL GRAPHITES Supplemental Report

C. E. Pepper, A. J. Pardi, and W. H. Dingeldein Dec. 1965 15 p refs

(Contract AT(30-1)-1156)

(NLCO-967) CFSTI: HC $1.00/MF $0.50

Graphite grades EP-192, EP-192C, and EP-1924 and a graphite designated General, were evaluated as anode electrodes to determine the graphite effect upon the carrier distillation excitation of impurities in U_3O_8. The carrier material was 10% AgCl–LiF (11:1 by weight). National SPK and Ultra U-7 graphite electrodes were included as reference electrodes. Quantometric time-resolved spectra were made to determine the relative spectral sensitivities of nine impurities in U_3O_8 with each graphite. The analytical precisions for eight impurities were also determined with each graphite. The POCO graphites did not show any significant advantages when compared with the U-7 and SPK graphites. In most comparisons they were excelled by the U-7 electrodes. Author (NSA)

N66-27924# Argonne National Lab., Ill.

A METHOD FOR AUTOMATIC ANALYSIS OF DATA ON THE KINETICS OF FAST CHEMICAL REACTIONS IN THE FORM OF PICTURES OF OSCILLOSCOPE TRACES

Myran C. Saver, Jr. Oct. 1965 15 p refs

(Contract W-31-109-ENG-38)

(ANL-7113) CFSTI: HC $1.00/MF $0.50

The CHLOE system for direct digitization of photographic data was used in conjunction with the Control Data Corporation 3600 Computer system to analyze data, in the form of pictures of oscilloscope traces, on the kinetics of fast chemical reactions. All measurements and analytical processes were done by machine in a completely automatic method.

Author (NSA)

N66-27927*# Florida Univ., Gainesville. Dept. of Chemistry.

DETERMINATION OF ELECTRON AFFINITY DIFFERENCES BY SURFACE IONIZATION

C. S. Harden, D. Stelman, and E. E. Muschlitz, Jr. [1966] 12 p refs Presented at the 14th Ann. Conf. on Mass Spectrometry, Dallas, May 1966 Submitted for Publication

(Grant NsG-67)

(NASA-CR-75656) CFSTI: HC $1.00/MF $0.50 CSCL 07D

The feasibility of using polyatomic molecules of halogens with two electronegative species is considered for the determination of (1) electron affinity differences and (2) molecular dissociation on a hot tungsten surface as a function of surface temperature. A well-collimated molecular beam is incident upon a small portion of a tungsten ribbon filament so that a negligible temperature gradient across the beam-surface interface results. Results indicate that these polyatomic molecules can be used at sufficiently high temperatures to determine electron affinity differences even though the results obtained showed an incomplete dissociation. The increasing degree of dissociation at lower temperatures may be explained by considering the C-F and C-Cl bond strengths, which are 4.4 eV and 3.3 eV, respectively; as temperatures increase the probability of breaking a C-F bond becomes greater than that of a C-Cl bond. It is not evident why the dissociation at higher temperatures remains constant even though it is less than unity. M.W.R.

N66-27930*# Missouri Univ., Kansas City. Dept. of Chemistry.

COMPLETE REACTION STUDIES IN EXOBIOLOGY: THE CHEMISTRY AND PHOTOCHEMISTRY OF NUCLEIC ACID CONSTITUENTS AND RELATED COMPOUNDS, AND THEIR DETECTION, CHARACTERIZATION, AND ISOLATION Semiannual Progress Report No. 4 (Final)

F. Millich 31 May 1966 25 p refs
(Grant NsG-651)
(NASA-CR-75646) CFSTI: HC $1.00/MF $0.50 CSCL 06A

Fluorescence spectra for purines, guanine, and benzimidazole are measured; and photometric determination is made of the kinetics of initial photochemical transformations of nucleotide derivatives in connection with a program dealing with complete reaction studies in exobiology. A special optical bench and auxiliary equipment were assembled to study the photometric rate of dry-sensitized photooxidation of purines. A tungsten source provides the energy to excite the dye and to begin the reaction. Data substantiate that methylene blue is subject to photooxidation, while the presence of guanine inhibits and delays the disappearance of the dye until the guanine content is exhausted. Progress is also reported on the isolation, characterization, and identification of photoproducts and sequential chemical products from the dye-sensitized photooxidation of guanine in alkaline solution.
M.W.R.

N66-27980# Bureau of Mines, Amarillo, Tex.
VAPOR PRESSURE OF CARBON DIOXIDE AT THE ICE POINT
Paul V. Mullins and Earle S. Burnett 1966 18 p refs
(BM-RI-6791)

Review and evaluation of all available data on the vapor pressure of carbon dioxide at the ice point, including previously unpublished results obtained by the Bureau of Mines, are presented. Suggested corrections and adjustments to all the data yield an average value of 26,136.4 mm mercury. Indicated agreement is within +1 part in 8000 to −1 part in 11000. A novel pressure bomb in which a sample of pure carbon dioxide is placed and sealed by a diaphragm fluid separator and its use as a reference pressure standard for extended and repeated use in the calibration of deadweight gages is described. Author

N66-27986# Aeronautical Research Labs., Melbourne (Australia).
THE DETERMINATION OF THE SOLUBILITY OF MAGNESIUM OXIDE IN VARIOUS SOLUTIONS BY ATOMIC ABSORPTION SPECTROSCOPY
L. Wilson Apr. 1965 26 p refs
(ARL/MET-25) CFSTI: HC $2.00/MF $0.50

The determination of the solubility of magnesium oxide in solutions containing various anions has been carried out by atomic absorption spectroscopy. Complications arising from the interfering effects of sodium and the anions on magnesium absorption in an air-coal gas flame have been eliminated by using an air-acetylene flame. It has been shown that each anion has its own specific effect on the solubility of magnesium oxide. Author

N66-27995# United Kingdom Atomic Energy Authority, Risley (England). Reactor Group.
THE ANALYSIS OF CARBON IN SODIUM
V. M. Sinclair, J. L. Drummond, and A. W. Smith 1966 15 p refs Presented at the 9th Conf. on Anal. Chem. in Nucl. Technol., Gatlinburg, Tenn., 12–14 Oct. 1965 *Its* Paper-38
(TRG-1185(D)) HMSO: 2s

The reactions of various carbon-containing compounds which could be present in sodium have been studied, to see whether a method of measuring total carbon by distillation of the sodium under reduced pressure and the subsequent measurement of the carbon in the residue by combustion techniques is sound and capable of measuring the total carbon. The source of "blank" levels of carbon in the distillation procedure has been examined. Methods for determining possible carbon-containing species in sodium, e.g., carbonate, carbide, carbonyl and free carbon, have been examined, and some reactions involving these species have been studied. Author

N66-27996# United Kingdom Atomic Energy Authority, Harwell (England). Research Group.
THE ANALYSIS OF URANIUM SILICIDES
G. W. C. Milner, D. H. Rowe, and G. Phillips Jan. 1966 20 p refs
(AERE-R-5129) HMSO: 2s 6d

A procedure is described for the chemical analysis of urnaium silicides varying in composition from the monosilicide to the disilicide. Dissolution of samples is achieved by preigniting at 850°C and then fusing with Na_2CO_3 in a nickel crucible. After extracting the melt with water, the silicon is converted to its silicomolybdate complex between pH 1.5 and 1.7. Excess of molybdate in solution is inactivated by the addition of concentrated hydrochloric acid, and then quinoline is added to precipitate quinoline silicomolybdate. The precipitate is filtered onto a sintered glass filter, dried at 150°C and then weighed. The silicon content is determined from the weight of precipitate, the precision of a determination being better than ±0.5% (1). For the determination of uranium, a separate sample is taken and dissolved in HNO_3+ HF. The determination is completed by controlled-potential coulometry on a sulphuric acid solution of the sample. The suitability of these procedures have been confirmed by employing them for the complete analysis of typical uranium mono- and disilicide samples. Author

N66-28058# Bureau of Mines, Salt Lake City, Utah. Metallurgy Research Center.
DECOMPOSITION OF MANGANESE SULFATE BY A PARTIAL REDUCTION PROCESS
Harry C. Fuller and Vernal E. Edlund 1966 25 p refs
(BM-RI-6794)

A method was devised and developed for decomposing manganese sulfate at a significantly lower temperature than that required by the conventional procedure of using heat alone. This technique, called the partial reduction method, effected decomposition at 700° to 800°C, as compared to 900° to 1,000°C normally required. The process consisted of heating, in the absence of oxygen, a mixture of manganese sulfate and a controlled quantity of a reducing agent. The suitability of commercial-type equipment was tested in laboratory-size models of an externally heated rotary kiln, a rabbled muffle-hearth furnace, and a fluidized-bed reactor. The rabbled-hearth furnace gave the best results with the least operating difficulty. It produced a gas containing more than 80 percent SO_2 and eliminated 96 percent of the sulfur when coal was used as the reductant. Sintering of the powdery decomposition product produced an agglomerate containing, in percent, 63.6 Mn and 0.4 S. Author

N66-28071# Boeing Co., Huntsville, Ala. Saturn Booster Branch.
PROPERTIES OF FLUORINE-OXYGEN MIXTURES
Edward C. Fohn and Larry C. Ball 30 Dec. 1965 45 p refs
(DS-12209)

Physical, thermodynamic and transport properties for several fluorine–oxygen mixtures are presented. Vapor

pressure, density, viscosity, thermal conductivity and nucleate boiling heat transfer coefficients were determined experimentally while the remaining properties were calculated from data of the pure components. Experimental work covered a temperature range of 100–550°R. Extrapolations were made up to 900°R. Author

N66-28091# Atomic Energy Establishment, Winfrith (England). Radiological and Safety Div.
THE EFFICIENCY OF WHATMAN TYPE ACG/B FILTER PAPERS FOR METHYL IODINE RETENTION IN AIR
R. E. Davis and J. M. E. Williams Nov. 1965 15 p refs (AEEW-M-568) HMSO: 2s 6d

Experiments are described in which charcoal-impregnated glass fiber filter papers were exposed to methyl iodide vapor and the penetration determined for iodide loadings ranging from 2×10^{-7} to 2×10^{-1} $\mu g/cm^2$ of filter area. Air was subsequently passed through the filters, and at intervals the amount of methyl iodide remaining on them was determined. Penetrations during loading varied from 30% to 80%, but after 10 minutes elution all filters retained less than 5% of the methyl iodide originally present. Author

N66-28098# Royal Aircraft Establishment, Farnborough (England).
POLYMERIZATION OF TETRAFLUOROETHYLENE OXIDE [POLIMERIZZAZIONE DELL'OSSIDO DI TETRAFLUOROETILENE]
P. Barnaba, D. Cordischi, M. Lenzi, and A. Mele Feb. 1966 14 p refs Transl. into ENGLISH from Chim. e Industr. (Milan), v. 147, no. 10, Oct. 1965 p 1060–1063
(RAE-LIB-TRANS-1152) CFSTI: HC $1.00/MF $0.50

The polymerization by ionizing irradiation of tetrafluoroethylene oxide in the solid state is studied. Polymerization does not take place if the monomer is irradiated in the liquid state. The effect of temperature on the rate of polymerization and on the molecular weight of the polymer has been examined. It has been found that the rate of polymerization and the molecular weight of the polymer have their maximum value around the fusion point. The polymer obtained shows a high degree of crystallization and is partially orientated. Author

N66-28129# Polish Academy of Sciences, Warsaw.
EPR STUDY OF THE KINETICS OF RADICAL FORMATION AND DISAPPEARANCE IN GAMMA RADIOLYSIS OF TETRAHYDRONAPHTHALENE [BADANIE METODA EPR KINETYKI TWORZENIA I ZANIKU RODNIKOW W GAMMA RADIOLIZIE TETRAHYDRONAFTALENU]
Zbigniew Kecki and Stanislaw Kosek Dec. 1965 18 p refs (Rept.-672/VXII/C) CFSTI: HC $1.00/MF $0.50

The kinetics of radical reactions in gamma irradiated frozen tetrahydornaphthalene was studied. The kinetic equations were derived; and the experimental results are discussed. Author

N66-28132# Polish Academy of Sciences, Warsaw.
THE APPLICATION OF REVERSED PHASE PARTITION CHROMATOGRAPHY TO THE SEPARATION OF MICRO AMOUNTS OF COBALT FROM IRRADIATED NICKEL [ZASTOSOWANIE CHROMATOGRAFII PODZIALOWEJ Z ODWROCONYMI PAZAMI DO WYDZIELANIA MIKROYLOSCI KOBALTU Z TARCZY NICKOWEJ]
Wiktor Smulek and Krystyna Zelenay Dec. 1965 16 p refs Presented at Conf. on Appl. of Phys. Chem. Methods in Chem. Anal., Budapest, 20–23 Apr. 1966
(Rept.-677/V.XIII/C) CFSTI: HC $1.00/MF $0.50

Reversed phase partition chromatography was used to separate, in microamounts, cobalt 58 from a neutron irradiated nickel target. Tri-n-octylamine retained on siliconated kieselguhr was used for the stationary phase; and elution was performed with hydrochloric acid of varying concentrations, water, and other eluants. The method was found to attain better separation than the use of Dowex 1×10 or Amberlite IRA-400. D.T.

N66-28137# United Kingdom Atomic Energy Authority, Windscale (England). Production Group.
AUTOMATIC MEASUREMENT OF FREE ACIDITY IN PROCESS SOLUTIONS BY COULOMETRIC TITRATION
D. T. Wooley, J. N. Money, and C. R. Mc Gowan 1966 21 p refs
(PG-692(W)) HMSO: 4s

The titrimeter was developed for the determination of free nitric acid in aqueous and organic plutonium purification process solutions. It was installed on the plant but was not connected in-line; samples were presented to it by hand but all other actions in the analytical sequence were carried out to an automatic programme. The titrant was generated by external electrolysis and the end-point was detected by photometry. Author

N66-28139# Royal Aircraft Establishment, Farnborough (England).
THE PREPARATION OF CERTAIN POLYBENZIMIDAZOLES, CONTAINING PHOSPHORUS, BORON AND OXYGEN ATOMS IN THE CHAIN [POLUCHENIE NEKOTORYKH POLIBENZIMIDAZOLOV, SODERZHASHCHIKH V TSEPI ATOMY FOSFORA, BORA I KISLORODA]
T. M. Frunze, V. V. Korshak, A. A. Izyneev, and V. V. Kurashev Jan. 1966 10 p refs Transl. into ENGLISH from Vysokomol. Soedineniya (Moscow), v. 7, no. 2, 1965 p 285–289 *Its* 10th Rept. in the Ser. "Preparation of Polymers by the Polycyclisation Reaction"
(RAE-LIB-TRANS-1145) CFSTI: HC $1.00/MF $0.50

Polybenzimidazoles containing hetero atoms of oxygen and phosphorus in the main chain were synthesized. Polybenzborimidazoline was prepared from 3,3',4,4'-tetraminodiphenylmethane and the tetrabutyl ester of 1,4-phenylenediboric acid. Details of the synthesizing process are given. The properties of the polymers are discussed and presented in tabular form, and include viscosity, color, cyrstalline or amorphous form, chemical structure, softening and decomposition temperatures, solubilities, and thermostabilities. It was determined that all the synthesized polymers are very thermostable, and that their solubilities are better than similar polybenzimidazoles which do not contain these hetero atoms. N.E.N.

N66-28146# United Kingdom Atomic Energy Authority, Harwell (England). Chemistry Div.
PROCEEDINGS OF THE SEMINAR ON THE PREPARATION AND STANDARDIZATION OF ISOTOPIC TARGETS AND FOILS
M. L. Smith, ed. Dec. 1965 193 p refs Conf. held at Harwell, England, 20–21 Oct. 1965
(AERE-R-5097) HMSO: 27s

CONTENTS:

1. MAKING ISOTOPIC TARGETS BY VACUUM EVAPORATION G. H. Debus et al p 1–47 refs

2. MAKING ISOTOPIC TARGETS BY OTHER METHODS: ELECTROSPRAYING, ELECTROPLATING, MOLECULAR PLATING, PAINTING, THERMAL CRACKING W. Parker et al p 48–102 refs

3. MAKING ISOTOPIC FOILS BY METALLURGICAL TECHNIQUES E. H. Kobisk et al p 103–122 refs

4. THICKNESS MEASUREMENT AND ASSAY OF ISOTOPIC TARGETS AND FISSION FOILS F. A. Howe et al p 123–173 refs

N66-28149# United Kingdom Atomic Energy Authority, Harwell (England). Chemistry Div.

THE DETERMINATION OF THE SPECIFIC ACTIVITY OF CARBON-14 LABELLED GRAPHITE. I: APPLICATION TO THE SPECIMEN USED IN THE DIDO FLOW APPARATUS SD 739/1

D. A. Dominey and B. P. K. Sharpe Jan. 1966 41 p refs (AERE-R-5141)

The methods used for the determination of the specific activity of carbon-14 labelled graphite are described in detail. These methods were applied to the measurement of the specific activity of the labelled specimen previously used in the DIDO gas-flow apparatus SD 739/1. The average specific activity is 2.4 mc/g. The results obtained by all the methods used are within 17% of this figure. When this specific activity is applied to the results of the experiments carried out with SD 739/1, G(−C) in pure CO_2 is 2.1±0.4. Author

N66-28155# United Kingdom Atomic Energy Authority, Harwell (England). Chemical Engineering Div.

THE CHEMISTRY OF SOLUTIONS OF HYDROGEN FLUORIDE IN TRINONYLAMINE

P. D. Blundy, W. H. Hardwick, M. P. Simpson, J. R. Stevens, and P. F. Wace Feb. 1966 30 p refs (AERE-R-5123)

An account is given of the solubility relationship of water, hydrogen fluoride and trinonylamine. The amine and acid are completely miscible if the water content of the system is sufficiently low. In general, however, the acid is divided between an aqueous and single organic phase but a second organic phase can be present at low HF concentrations. The vapour pressure of the three constituents, together with other physical properties of the system show that an amine bifluoride is readily formed to which further molecules of HF may be attached by hydrogen bonding. The chains are terminated by a water molecule, although in the presence of diluents such as xylene, less water is present in the organic phase. Author

N66-28158# Aktiebolaget Atomenergie, Studsvik (Sweden).

THEORETICAL TIME DEPENDENT THERMAL NEUTRON SPECTRA AND REACTION RATES IN H_2O AND D_2O

S. N. Purohit Apr. 1966 70 p refs (AE-226) CFSTI: HC $3.00/MF $0.75

Time dependent spectra and reaction rates were obtained for resonance detectors using several different scattering models of H_2O and D_2O, and the time dependent, one dimensional Boltzman equation. The study was undertaken in order to interpret previous integral time dependent neutron thermalization experiments in liquid moderators. The proton and deuteron gas models proved to be inadequate to explain the measured reaction rates in H_2O and D_2O. The bound models of Nelking for H_2O and of Butler for D_2O gave much better agreement with the experimental results than the gas models. It was also found that the bound model of Butler and the effective mass 3.6 gas model of Brown and St. John gave almost identical reaction rates. D.T.

N66-28162# Polish Academy of Sciences, Warsaw.

DETERMINATION OF THE CRYSTAL STRUCTURE OF LITHIUM FERRITES–CHROMITES ABOVE THE CURIE POINT [WYZNACZENIE STRUKTURY KRYSTALICZNEJ FERRYTOW–CHROMITOW LITOWYCH POWYZEJ TEMPERATURY CURIE]

Nov. 1965 18 p refs In RUSSIAN; ENGLISH summary (INR-664/II/PS) CFSTI: HC $1.00/MF $0.50

Neutron diffraction techniques were used to investigate the crystal structures of lithium ferrite–chromite described by the formula:

$$Li_{1-x}Fe_x[Li_{x-0.5}Fe_{2.5-x-u}Cr_u]O_4$$

for a=1.25, 1.50, 1.60, and 1.70. The degree of inversion x and the oxygen parameter u were determined from diffraction patterns taken above the Curie temperatures. In addition, it was found that an ordering exists in the A sublattice for samples with a=1.60 and 1.70. D.T.

N66-28176# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Siebersdorf (Austria). Institut für Chemie.

GAS CHROMATOGRAPHY RESEARCH OF VOEST/ANTHRACENE OIL I [GASCHROMATOGRAPHISCHE UNTERSUCHUNGEN AN VOEST-ANTHRAZENOEL I]

E. Proksch and W. Szinovatz 1966 29 p refs In GERMAN; ENGLISH summary Submitted for Publication (SGAE-CH-26/1966) CFSTI: HC $2.00/MF $0.50

The separation of the components of VOEST Anthracene Oil I has been achieved using a programmed (160–210°C) 0.25 mm capillary column, stationary phase polyphenyether OS 138 (up to 80,000 theoretical plates at 50 m length). In a single run abt. 110 individual components, all of them being neutral compounds, may be detected. Therefrom 28 (making up abt. 85 w/o of the neutral oil) could be identified definitely. Basic and phenolic compounds had to be analyzed for separately following a chemical separation. Plotting the logarithms of retention time versus boiling points yields a common straight line for neutral and basic compounds with but small deviations. Phenolic compounds elute earlier than according to the above relation. By replacement of the polyphenylether by Apiezon M the resolution decreases, but is still high enough for the neutral components. Bases and phenols, however, show considerable tailing. Whereas the phenols elute together with the neutral components, the quinoline and acridine bases elute earlier in that case. Author

N66-28189# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf (Austria). Institut für Chemie.

THE CHEMISTRY OF THE "MOLECULAR PLATING" PROCESS [DER CHEMISMUS DES "MOLECULAR PLATING" VERFAHRENS]

E. Proksch, N. Getoff, H. Bildstein, H. Saukel, H. Eschweiler et al Feb. 1966 23 p refs In GERMAN; ENGLISH summary Submitted for Publication (SGAE-CH-28/1966) CFSTI: HC $1.00/MF $0.50

A number of platings obtained by electrolysis of metal salt solutions highly diulted with certain alcohols or ketones

("Molecular Plating" process) have been investigated by IR reflection spectroscopy. With the exception of the noble metals, the primary cathodic deposit consists of hydroxides or oxides, irrespectively of the nature of the metal salt used. The electrolytic deposition processes are accompanied by decomposition of the water contained in the solution and by an attack to the organic solvent (dimerization and oxidation), as could be shown by gas chromatographic analysis.
Author

N66-28227# Ministry of Aviation, Pinner (England). Technical Information and Library Services.
EXPLOSIVE REACTIONS IN CONDENSED SYSTEMS AND THE KINETICS OF THE THERMAL DECOMPOSITION OF TRINITROGLYCERINE [VZRYVNYE REAKTSII V KONDENSIROVANNYKH SISTEMAKH I KINETIKA TERMICHESKOGO RAZLOZHENIYA TRINITROGLITSERINA]
S. Z. Roginskii and L. M. Sapozhnikov Mar. 1966 28 p refs Transl. into ENGLISH from Zh. Fiz. Khim. (Moscow), v. 2, no. 1, 1931 p 80–101
(TIL/T-5414) CFSTI: HC $2.00/MF $0.50

Analysis of the kinetics of the thermal decomposition of nitroglycerine in a temperature range from 120 deg. to 190 deg. The authors discuss the spontaneous monomolecular disintegration and the autocatalytic decomposition of nitroglycerine and the conditions determining them. Effect of inert solvents and activation heats. Mechanism of monomolecular decomposition and the significance of autocatalysis.
Author

N66-28233# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf (Austria).
A CONTRIBUTION TO QUANTITATIVE ACTIVATION PURITY DETERMINATION OF RARE EARTH OXIDES [EIN BEITRAG ZUR QUANTITATIVEN AKTIVIERUNGSANALYTISCHEN REINHEITSBESTIMMUNG VON SELTENERDOXYDEN]
H. Bildstein, H. Auer-Welsbach, and H. Manhartsberger 1966 15 p refs In GERMAN Submitted for Publication
(SGAE-CH-27/1966) CFSTI: HC $1.00/MF $0.50

Quantitative tracer determination of europium in gadolinium, praseodymium and neodyium, and lutetium in ytterbium was accomplished through activation of the samples followed by separation on cation exchangers. Complete separation of europium and gadolinium and of praseodymium and neodymium was achieved with watery ammonium-α-hydroxyisobutyrate solutions; ammonium lactate was found better suited for separation of ytterbium and lutetium. The position of the elution mark was reproducible in each case.
Transl. by K.W.

N66-28249# Uppsala Univ. (Sweden). Quantum Chemistry Group.
A QUANTUM MECHANICAL MODEL FOR SIMPLE MOLECULAR REACTIONS Scientific Report No. 49
David A. Micha 15 Jul. 1965 49 p refs *Its* Preprint No. 155 (Contract AF 61(052)-701)
(ARL-66-0026; AD-631290) CFSTI: HC $2.00/MF $0.50

The exchange reaction A+BC to AB+C for a system of three atoms interacting under an aligning potential is studied using the integro-differential method for complex collisions. A two-state approximation leads to a pair of coupled equations which is solved by using a distorted wave for the initial channel relative motion and by introducing the Green function for the final channel relative motion. Total and differential reaction cross-sections are evaluated from the asymptotic form of the wave functions. The invariance of the system under time-reversal is used to relate the direct and reverse reactions. The model gives the dependence of the relative motion potential on the molecular quantum numbers, shows that the alignment introduces a centrifugal potential, that the initial and final molecular angular momenta must be equal and that a threshold energy exists, depending on the initial and final molecular states. It suggests the way of finding lower bounds to the threshold energies. The advantages and approximations for the model are discussed and possible generalizations pointed out.
Author (TAB)

N66-28277# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PREPARATION OF LOW-FREEZING-POINT OILS BY DEPARAFFINING WITH CARBAMIDE
M. G. Mitrofanov and O. A. Artem'yeva 23 Mar. 1966 9 p Transl. into ENGLISH from the publ. "Uluchsheniye Kachestva i Sovershenstvovaniye Proizvodstva Smazochnykh Masel" Moscow, Gostoptekhizdat., 1963 p 173–176
(FTD-TT-65-1509/1+4; AD-631449) CFSTI: HC $1.10/MF $0.50

Results are described of studies concerning the preparation of low-freezing-point transformer and spindle oils by extracting paraffins from various petroleum distillates with carbamide.
TAB

N66-28279# Uppsala Univ. (Sweden). Quantum Chemistry Group.
ANGULAR DISTRIBUTION OF PRODUCTS OF HYDROGEN ATOM–HYDROGEN MOLECULE REACTIONS Scientific Report No. 51
David A. Micha 1 Aug. 1965 24 p refs *Its* Preprint No. 157 (Contract AF 61(052)-701)
(ARL-66-0025; AD-631323) CFSTI: HC $2.60/MF $0.50

A previously developed theoretical model is used to describe the reactions of $D+H_2=DH+H$ and $H+D_2=HD+D$. Analytical expressions for the cross-sections are given and the permutational symmetry problem is briefly discussed. The results show a threshold region of relative kinetic energies, for which the reactions lead most probably to backward scattering in the center of mass system, the partial cross-sections with small relative angular momenta being dominant. At larger energies forward scattering is the most probable and the partial cross-sections with the highest relative angular momenta dominate. Comparison with experiments indicate agreement with the measured scattering directions, with the speed of HD product molecules and with the absolute value of differential cross-sections. The calculations predict an undetected forward scattering peak in the case of $H+D_2$, and show that the HD molecules from these reactions are mostly in low excited rotational states.
Author (TAB)

N66-28280# Institute of Modern Languages, Inc., Washington, D. C.
THE INFLUENCE OF SOME OXIDES ON THE REDUCTION OF VARIOUS TYPES OF LEAD-SILICATE GLASS IN HYDROGEN [VLIAIANIE NEKOTORYCH OKISLOV NA VOSSTANOVLENIE V VODORODE SVINZOVO-SILIKATNYCH STEKOL]

I. I. Kitaygorodsky, E. A. Fainberg, and L. A. Grechanik Ft. Belvoir, Va., Army Engr. Res. and Develop. Labs., Apr. 1966 10 p refs Transl. into ENGLISH from Glass and Kera-mika (USSR), no. 12, 1962 p 8-10
(Contract DA-44-009-AMC-1563(T))
(ERDL-T-1831-66; TT-66-61087; AD-631433) CFSTI: HC $1.00/MF $0.50

A method was developed which makes it possible to compare the reducibility of various types when they are heat-treated in a hydrogen atmosphere. A study of the effects of metal oxides on the reducibility of lead-silicate glass revealed oxides which activate and retard reduction. Consideration was also given to the effect of various alkaline metal ions on the reduction of glass with a high content of PbO. TAB

N66-28303# Louisiana State Univ., Baton Rouge. Dept. of Chemistry.
EXPERIMENTAL STUDY OF THE ELECTRICAL DOUBLE LAYER IN VERY DILUTE AQUEOUS SOLUTIONS
Paul Delahay, Robert De Levie, and Anna-Maria Giuliani Feb. 1966 12 p refs Submitted for Publication
(Contract Nonr-1575(04))
(TR-60; AD-631625) CFSTI: HC $1.60/MF $0.50

Two methods are described for the measurement of the double layer differential capacity in media of low conductivity, i.e., under conditions in which the conventional bridge method fails: (a) measurement of the change of potential caused by coulostatic charging with a small excursion of potential; (b) determination, under coulostatic conditions, of the time constant of the circuit comprising the double layer capacity in series with a large resistance. The first method is definitely the more convenient and slightly more accurate. Application is made of 0.001 to 0.00001 M sodium fluoride, and results agree with those calculated from the Gouy-Chapman theory for Grahame's capacities of the compact double layer. The coulostatic method is compared with the bridge method and some potential applications are mentioned. Author (TAB)

N66-28315# Uppsala Univ., (Sweden). Quantum Chemistry Group.
THE EXCHANGE REACTION OF H AND H_2 Scientific Report No. 50
David A. Micha 15 Jul. 1965 28 p refs *Its* Preprint No. 156
(Contract AF 61(052)-701)
(ARL-66-0028; AD-631291) CFSTI: HC $2.00/MF $0.50

The exchange reaction of a hydrogen atom and a hydrogen molecule is studied with a quantum mechanical model for systems under aligning forces. The consideration of the nuclear spins to describe the para-ortho conversion introduces a factor 3/4 in the coordinate dependent cross-sections. An analytical expression is obtained for the total cross-section σ by using a piece-wise interaction potential and computational simplifications. Calculations of σ as a function of the initial relative wave number k, for $k \leq 7.00$ a.u. show a threshold for σ followed by an oscillatory behavior around a mean $\sigma_{av}=0.50$ a.u. This function is shifted to larger k when increasing the potential strength and the initial molecular angular momentum, but only slightly in the last case. The change in σ is noticeable when varying the range of the chemical interaction and the hard-core radius of the H_3 potential. The mean value σ_{av} increases when the hard-core radius grows, but seems fairly independent of the other parameters. Author (TAB)

N66-28327# Royal Aircraft Establishment, Farnborough (England).
RADIATION EFFECTS IN FLUOROLUBE
M. J. Downey Feb. 1966 21 p
(RAE-TR-66024) CFSTI: HC $1.00/MF $0.50

This report describes a preliminary program of work undertaken in order to examine the effects of gamma radiation on fluorolube. The changes in viscosity and the amount of gas evolved, under certain conditions, as a result of doses of 10, 40, 100, 150 and 200 megarads, are given. Author

N66-28329# Atomic Weapons Research Establishment, Aldermaston (England).
A VERSATILE AND CHEAP VACUUM LEAK
P. M. S. Jones, R. Gibson, and J. A. Evans Feb. 1966 23 p refs
(AWRE-O-10/66) HMSO: 3s

A versatile vacuum leak has been developed for use with light gases. Leak rates in the range 10^{-11} to 10^{-8} std ml/s have been used but greater variations are readily attainable in principle. The leak rate is proportional to the applied gas pressure and leak area, and the leak can be operated conveniently at room temperature. For high precision work a thermostat would be advantageous since the rate varies by 5% per degree centigrade. The leak has been used with deuterium, helium and tritium. In the latter case radiolytic damage to the membrane produces hydrogen and reduces the permeability so that only ≈3 months use is advisable. The effects of radiation on the membrane are discussed. Author

N66-28345# Bureau of Mines, Bartlesville, Okla. Bartlesville Petroleum Research Center.
SYNTHESIS OF ALKYL CYCLOALKYL AND DICYCLOALKYL SULFIDES
R. W. Higgins, R. L. Hopkins, H. J. Coleman, C. J. Thompson, and H. T. Rall (Tex. Woman's Univ.) 1966 20 p refs
(BM-RI-6796)

Fifteen alkyl cycloalkyl sulfides and three dicycloalkyl sulfides were synthesized to provide reference compounds in the search for these classes of sulfur compounds in crude oils. In synthesizing sulfides by alkaline alkylation the order in which the reactants were added was shown to determine the yield and purity of the product. Author

N66-28349# Los Alamos Scientific Lab., N. Mex.
SPECTROPHOTOMETRIC DETERMINATION OF MICROGRAM AMOUNTS OF THORIUM IN PLUTONIUM
G. B. Nelson, G. R. Waterbury, and W. J. Baughman 14 Mar. 1966 13 p refs
(Contract W-7405-ENG-36)
(LA-3469) CFSTI: HC $1.00/MF $0.50

Thorium when present in the concentration range of 15 to 140 ppM in plutonium-containing materials is measured spectrophotometrically as the thorium-thorin complex. This measurement is made following separation of thorium by precipitation as thorium fluoride, with lanthanum fluoride carrier, while plutonium is oxidized to the fluoride-soluble (VI) oxidation state. The molar absorptivity of the thorium-thorin complex is 16,600 at 545 mμ. The relative standard deviations in determining 5 and 17 μg (10 and 34 ppM) of thorium are 11 and 4%, respectively. In the range of 39 to 73 μg (66 to 146 ppM) of thorium, the relative standard deviation is not greater than 1.0%. The average for the thorium found in 91 determinations of 5 to 73 μg of thorium was 99±1%. Author (NSA)

N66-28363# Atomic Energy Commission, New Brunswick, N. J.
NEW BRUNSWICK LABORATORY ANNUAL PROGRESS REPORT, JULY 1964–JUNE 1965
Dec. 1965 85 p refs
(NBL-230) CFSTI: HC $3.00/MF $0.75

Analyzed samples of elemental B for impurity determinations are being prepared. The B-10 radioactive scrap recovery program was reactivated. The evaluation of the methods in TID-7029 is nearing completion. A direct method of spectrochemical analysis of impurities in B is described. A method for determining U and Pu by isotope dilution analysis involving alpha spectrometry with a semiconductor detector is described. A method for the determination of F in the presence of relatively large amounts of O by fast neutron activation was developed. The method for the determination of 10B by thermal neutron absorption using neutrons from Ra–Be sources was modified by the use of Pu–Be sources. Methods for the determination of impurities in elemental B by fast neutron activation (14 MeV) using a Cockcroft–Walton accelerator are being developed and evaluated. A revision of a flip-flop source filament loading assembly is described. Changes made in mass spectrometers and procedures used for analyses of B materials to determine more reproducible ratios are summarized. Modifications were made in mass spectrometers used for the isotopic analyses of U. A method for the ion-exchange separation and gravimetric determination of sulfate sulfur in thorium nitrate is presented. Methods for determination of B in Al–B mixtures are presented. A method for analysis of micro- and milligram quantities of U in press cakes and other scrap materials is presented. An isotopically homogeneous lot of about 250 g. of plutonium sulfate tetrahydrate was prepared for an isotopic Pu standard. The use of ThO_2 and ThO_2–UO_2 in preparation of analytical working curve standards for determination of B in ThO_2(96%)–$^{233}UO_2$(4%) samples was compared. A commercial automatic titrator was modified for use in determining Pu with potassium dichromate. Data are given to compare results using Cr-target X-ray tubes with those obtained with W-target tubes. Standard specifications for a carrier-distillation type anode cap electrode are presented. Author (NSA)

N66-28368*# National Aeronautics and Space Administration, Washington, D. C.
IONIZATION OF CHLORINE AND IODINE IN FUSED SALTS [IONIZATSIYA KHLORA I YODA V RASPLAVLENNYKH SOLYAKH]
G. N. Trusov, S. R. Borisova May 1966 16 p refs Transl. into ENGLISH from Elektrokhimiya (USSR), v. 1, no. 6, 1965 p 709–713
(NASA-TT-F-10158) CFSTI: HC $1.00/MF $0.50 CSCL 07B

Chlorine ionization was studied with carbon and graphite electrodes; iodine was studied on a tungsten electrode. It was found that the current increase on the tri-phase boundary is related to the diffusion increase through the thin layer of melt. Author

N66-28370*# National Aeronautics and Space Administration, Washington, D. C.
STUDY OF THE FORMATION REACTION OF POLYBENZIMIDAZOLES [ISSLEDOVANIYE REAKTSII OBRAOVANIYA POLIBENZIMIDAZOLOV]
V. V. Korshak, T. M. Frunze, V. V. Kurashev, and A. A. Izyneyev May 1966 12 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 149, no. 1, 1963 p 104–106
(NASA-TT-F-10174) CFSTI: HC $1.00/MF $0.50 CSCL 07C

The mechanism of the synthesis of polybenzimidazoles is investigated using the example of the polycondensation reaction of 3,3'-diaminobenzidine with the diphenyl ester of sebacic acid. Thermographic analyses showed the reaction temperature to be of major significance. An increase led to a sharp rise in molecular weight of the polymer and shortening of the reaction time. During the first stages, the reaction is accompanied by cessation of chain growth; during later stages, the equilibrium character is lost due to the presence of extemely stable benzimidazole rings in the macromolecules. Author

N66-28379*# Melpar, Inc., Falls Church, Va.
DETECTION OF CARBON DIOXIDE WITH CHEMICAL TAPES Final Report
Dec. 1965 140 p refs
(Contract NAS9-2883)
(NASA-CR-65378) CFSTI: HC $4.00/MF $1.00 CSCL 07C

A summary is presented of the efforts in developing carbon dioxide sensitive tapes which are capable of reacting to various levels of carbon dioxide after having been stored for long periods of time under various conditions of temperature, humidity, and pressure. Statistical analyses were performed and the manufacturing variables which have affected the performance of the tapes were investigated. The results of these considerations are discussed. A study was made concerning the reproducibility of the reaction occurring between the tapes and carbon dioxide to define the reliability that could be expected from this device. Included in these studies were the examination and the determination of the human error associated with optically detecting the color change on these tapes. A complete description of these detectors is provided, and the data derived from the tests conducted are shown in graphs. H.S.W.

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N66-26984# Washington Univ., Seattle.
DIELECTRIC LOADING OF AN ELECTROMAGNETIC HORN
James C. Rogers (M.S. Thesis) 1966 66 p refs

The possibility of controlling the radiation pattern of electromagnetic horn antennas is examined. The lens used for shaping the antenna beam was made from homogeneous material with portions removed to vary the dielectric properties. Differential equations are formulated for the electromagnetic fields in a dielectric loaded waveguide, and these field distributions are then used to calculate the expected radiation pattern for an H-plane horn. The assumed dielectric variations are approximated. Dielectric slabs with step variations in dielectric constant are inserted in the mouth of an H-plane electromagnetic horn, and experimental radiation patterns are obtained. Computer programs for computing these patterns are also included. Theoretical and experimental radiation patterns are compared, and the differences are assessed. In general, the results show the feasibility of the method. M.G.J.

N66-27019# Bendix Corp., Baltimore, Md. Radio Div.
BENDIX RADIO TECHNICAL DIGEST, JULY–SEPTEMBER 1965
[1965] 48 p refs

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3. A NEW APPROACH TO RADAR SPECTRUM SIGNATURE RECORDING A. E. F. Grempler and A. P. Carlson (RADC) 12 p (See N66-27022 15-07)

N66-27020# Bendix Corp., Baltimore, Md. Radio Div.
A NEW MULTI-LEVEL CODING TECHNIQUE FOR DIGITAL COMMUNICATIONS
J. L. Shagena and J. C. Kvarda *In its* Bendix Radio Tech. Dig., Jul.–Sep. 1965 [1965] 17 p refs (See N66-27019 15-07)

In bandwidth limited digital communication systems, it is possible to increase the data rate at the expense of demanding a higher signal-to-noise ratio in the transmission medium. This multi-level coding scheme allows adjustment of this data rate to match the capacity of the channel while maintaining a constant bandwidth; or conversely, for a fixed data rate, it compresses the bandwidth by requiring a higher signal-to-noise ratio. A data modem equipment using this technique has been developed and is also described in this paper. Author

N66-27021# Bendix Corp., Baltimore, Md. Radio Div.
COMPARISON OF RADIO WITH OPTICAL TWILIGHT
Thomas J. Carroll *In its* Bendix Radio Tech. Dig., Jul.–Sep. 1965 [1965] 12 p refs (See N66-27019 15-07)

Some recent measurements have been made of the intensity of optical and near infrared propagation in good visibility conditions to a distance about nine times the horizon. The db/km attenuation rate of the twilight region, adjusted to allow for Rayleigh molecular scattering of light, is in order of magnitude agreement with the analogous rates for radio waves, both those observed experimentally and those calculated from mode theory. Aerosol scattering probably usually dominates the twilight due to molecular scattering at optical frequencies, although negligible at radio frequencies. Dry air has the same index of refraction for radio and optical frequencies, but water vapor has the higher index for radio frequencies. Even the sharp drop at the optical horizon, although equal to the single mode diffraction rate of classical radio theory. It seems certain that no interpretation of optical twilight as scattering from turbulence is possible, because the optical wavelength is about four orders of magnitude less than the micro-scale of turbulence in air. Turbulent eddies smaller than the micro-scale, whose energy is irreversibly converted into heat by viscosity effects, cannot be imagined to exist and to be confused in their scattering properties with molecular scattering common to both radio and optical frequencies. Author

N66-27022# Bendix Corp., Baltimore, Md. Radio Div
THE FSM-17: A NEW APPROACH TO RADAR SPECTRUM SIGNATURE RECORDING
A. E. F. Grempler and A. P. Carlson (RADC) *In its* Bendix Radio Tech. Dig., Jul.–Sep. 1965 [1965] 12 p (See N66-27019 15-07)

This paper discusses the construction and operation of the AN/FSM-17(XW-1) Radiation Pattern Recorder. The FSM-17 is in inventory and is currently being used to provide information to the Electromagnetic Compatibility Analysis Center (ECAC). Author

N66-27423# American Meteorological Society, Boston, Mass.
SOME PROBLEMS OF RADAR TRACKING OF MULTIPLE TARGETS [NEKOTORYE VOPROSY RADIOLOKATSII MNOZHESTVENNOI TSELI]
A. G. Gorelik and A. A. Chernikov Jan. 1966 20 p refs Transl. into ENGLISH from Tr. Tsentr. Aerolog. Observ. (Moscow), no. 57, 1964 p 77–86
(Contract AF 19(628)-3880)
(TT-66-60838; AD-630556) CFSTI: HC $1.00/MF $0.50

In the paper, relationships are obtained for the power, correlation function, and spectrum of an echo from an aggregate of scatterers, as applied to the problem of investigating the dynamics of the atmosphere, using conventional and pulse-coherent radars. Author (TAB)

N66-27435# Lincoln Lab., Mass. Inst. of Tech., Lexington.
LINCOLN EXPERIMENTAL TERMINAL ANTENNA SYSTEM
Bernard F. La Page 4 Oct. 1965 57 p refs *Its* Tech. Rept. 404
(Contract AF 19(628)-5167)
(ESD-TDR-65-458; AD-630702) CFSTI: HC $3.00/MF $0.75

The Lincoln Experimental Terminal (LET) is a small transportable ground terminal for testing and evaluating space communications techniques. The requirements, design analysis, and performance data for the LET antenna and feed system are described. The 15-foot-aperture antenna has Cassegrainian optics, and a conical-horn-reflector feed exciter producing opposite-hand circularly polarized transmitting and receiving beams. The simultaneous operation of a two-channel tracking system is also discussed. Author (TAB)

N66-27438# Bureau of Ships, Washington, D. C.
PERFORMANCE CHARACTERISTICS OF RADAR PHASED ARRAYS
R. T. Hill [1965] 29 p refs Presented at Assoc. of Senior Engr. 3d Ann. Tech. Symp.
(AD-630819) CFSTI: HC $2.00/MF $0.50

The performance of Radar Antennas of a conventional rotating type can be specified and interpreted with relative ease. The performance of fixed antennas (phased arrays) can be described only by families of multivariate functions, which lead themselves to statistical rather than deterministic analysis. The nature of these functions, including an examination of some transient effects, is illustrated in pictorial ways (3-dimensional graphs), and some new performance concepts are defined. Not only is the distinct change in performance interpretation urgent for the microwave engineer and system specifier, it is also important that those concerned in less direct ways with Navy radar operation have an appreciation of these properties. Author (TAB)

N66-27580# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A UNIFIED MULTICHANNEL TELEMETERING SYSTEM FOR THE STUDY OF NUCLEAR RADIATIONS
A. A. Bragin and R. F. Fedoriv 17 Mar. 1966 8 p refs Transl. into ENGLISH from Vopr. Peredachi Inform. (USSR), no. 3, 1964 p 118–121
(FTD-TT-65-1889/1+2+4; TT-66-60994; AD-630998) CFSTI: HC $1.10/MF $0.50

Details are given on an instrument designed to measure nuclear radiation in such remote locations as drill holes. In the unified multichannel telemetering system described, the choice of channel numbers and the range of measured intensities can be made by changing the number of identical units. Time separation of the channels makes it possible to use a single line of communication and automatically eliminates any interchannel interference. The pulse of the radiation pickup goes to the counting units of its channel, with the number of units selected based on the amount of information to be transmitted and the carrying capacity of the system. The pulses of the last counting units are stored by the memory units and counted at the moment of interrogation; the memory units are questioned by the multiphase vibrator, by which the time division of the channels is attained. A voltage drop occurs when the memory unit is triggered. The signal is amplified as it passes along the communication line; the output pulse of the marker triggers the multiphase vibrator, which is the basis of the commutator on the receiving side of the system. Use of correcting integrators are recommended for obtaining a linear scale over the measurement range. M.G.J.

N66-27591# American Meteorological Society, Boston, Mass.
EFFECTIVENESS AND RELIABILITY OF RADAR OBSERVATIONS OF NON-PRECIPITATING CLOUDS [EFFEKTIVNOST' I OBESPECHENNOST' RADIOLOKATSIONNYKH OBNARUZHENNII OBLAKOV, NE DAIUSHCHIKH OSADKOV]
R. V. Ignatova and V. A. Petrushevskii Bedford, Mass., AFCRL, Jan. 1966 14 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 173, 1965 p 3–8
(Contract AF 19(628)-3880)
(T-R-522; AD-630676) CFSTI: HC $1.00/MF $0.50

The present paper deals with determination of the effectiveness and reliability of cloud observations; experimental data are given on the observation of various cloud types using weather radars, and the method of carrying out radar observations of clouds is discussed. Author (TAB)

N66-27616# Syracuse Univ. Research Inst., N. Y.
PERIODICALLY LOADED TRANSMISSION LINES Task Report No. 14
Jose Perini Griffiss AFB, N. Y., RADC, Mar. 1966 80 p refs
(Contract AF 30(602)-2646)
(EE957-6511T14; RADC-TR-65-474; AD-631450) CFSTI: HC $3.00/MF $0.75

In this report equations for the transmission parameters of a periodically loaded line are derived with no restrictions on magnitude, type or number of discontinuities and on attenuation on the line. Of interest are the input reflection coefficient and the generator to load transmission coefficient of the line when terminated by its characteristic impedance. The equations for these coefficients are readily derived from the transmission parameters. Several plots of the input reflection coefficient and transmission coefficient are presented and compared with experimental results. The agreement is very good. Among other important results, it is shown that maximum transfer of power to the load, through a periodically loaded line, does not always occur for minimum input VSWR. In fact, for the case of purely resistive shunt discontinuities, it corresponds to the maximum input VSWR and for the case of mixed discontinuities the minimum input VSWR does not correspond either to minimum or maximum power transfer. In such cases the transmission coefficient presents a peculiar behavior near its maximum having a sharp minimum near one side of the maximum which should be avoided. Author (TAB)

N66-27617# State Univ. of New York, Stony Brook. Coll. of Engineering.
ANALYSIS AND SYNTHESIS OF APERTURE FIELDS OF LOG PERIODIC ANTENNAS Scientific Report No. 2
Richard B. Kieburtz 31 Aug. 1965 37 p refs *Its* Tech. Rept.-51
(Contract AF 19(628)-4144)
(AFCRL-65-800; AD-631674) CFSTI: HC $2.00/MF $0.50

The paper establishes the relationships between the variation of field intensity along the surface of a log-periodic (L.P.) antenna and the propagation constant of its uniformly periodic prototype. The prototype is then studied to determine the effect of modifications of the structure on the aperture field of the L.P. antenna. It is proposed that the directivity of an L.P. antenna may be improved by designing it for multi-mode operation with multiple active regions from which radiation occurs. In order to evaluate the coupling of modes in the active regions of an L.P. dipole array a simple coupled mode periodic transmission line model has been employed. Between active regions the characteristic impedances of the two dominant modes are badly mismatched and little coupling occurs. In an active region the modes are strongly coupled and the resulting perturbation of the propagation constants is evaluated by coupled-mode theory. The effect of variation of several parameters of the structure to bring about desired modifications of the dispersion curve is also investigated. Author (TAB)

N66-27629# Sylvania Electric Products, Inc., Waltham, Mass.
INCIDENCE MATRIX APPLICATIONS Final Report, Apr. 1964–Apr. 1965
Richard Turyn Griffiss AFB, N. Y., RADC, Apr. 1966 128 p refs
(Contract AF 30(602)-3334)
(RADC-TR-65-175; AD-631615) CFSTI: HC $4.00/MF $1.00

This report is in two parts. The first part deals with certain finite configurations which have been applied in the design and analysis of statistical experiments. Some of their mathematical properties are examined, certain ones are described in detail and some new results, particularly on generalizations employing roots of 1 other than ±1 are reported. The applications of these configurations to the construction of various codes are discussed. The second part is a study of a hypothetical-self-synchronizing coding system based on codes derivable from some of the configurations described in the first part. Author (TAB)

N66-27635# Hughes Aircraft Co., Culver City, Calif. Research and Development Div.
ON THE PROBLEM OF ANTENNA PATTERN SYNTHESIS AND OPTIMUM APERTURE DISTRIBUTION UNDER CONSTRAINT Scientific Report No. 6
Thomas S. Fong Bedford, Mass., AFCRL, Dec. 1965 27 p refs
(Contract AF 19(628)-4349)
(P66-12; AFCRL-66-138; AD-631486) CFSTI: HC $2.60/MF $0.50

The antenna pattern synthesis problem for a finite line source is formulated and treated in the space of absolutely square-integrable functions. A close examination is made of the condition that must be imposed on the desired radiation

pattern so that the problem is solvable. The optimum aperture distribution is determined by the variational technique. Subject to the requirement that the approximating radiation patterns should have a superdirective ratio less than or equal to some fixed positive value. The optimality of the solution is demonstrated by considering the sufficient condition. The error criterion is measured in the mean-square sense. Author (TAB)

N66-27638# Pennsylvania Univ., Philadelphia. Moore School of Engineering.
FREZNEL ZONE THEORY Interim Technical Report
W. R. Lind Griffiss AFB, N. Y., RADC, Mar. 1966 246 p refs
Its Rept.-66-20
(Contract AF 30(602)3290
(RADC-TR-66-66; AD-631484) CFSTI: HC $6.00/MF $1.25

This report is concerned with 'the state of the art' of Fresnel zone theory. Starting with Maxwell's equations expressions are obtained for fields, power density, and gain in the near field of aperture antennas. The effect of the size, shape, and aperture distribution of a 'probe' which is used to measure antenna parameters in the Fresnel region and power transfer between antennas located in each others Fresnel region is also discussed. The above quantities are discussed for various aperture distributions and aperture shapes. The effect of obstacles and the ground in the Fresnel region of an antenna on its performance are presented. Various methods, together with their limitations, for measuring Fraunhofer antenna data in the Fresnel region are also discussed. Experimental data have been included whenever available. Author (TAB)

N66-27642# Pennsylvania Research Associates, Inc., Philadelphia.
INVESTIGATION OF COMPUTER TECHNIQUES FOR RADAR LANDMASS SIMULATION Final Report, 1963–1965
Port Washington, N. Y., Naval Training Device Center, Feb. 1966 356 p refs
(Contract N61339-1526)
(NAVTRADEVCEN-1526-1; AD-631592) CFSTI: HC $7.00/MF $1.75

Advanced mathematical and computational techniques for simulation of the display produced by an airborne radar over a wide range of flight regimes and radar equipments. Incorporation of a small-scale, general-purpose digital computer, in combination with specialized methods of efficient terrain representation, to control special-purpose analog function generation circuits. Resulting waveform, simulated in real time under operator control without necessity for preprogramming of flight path, is to be displayed for advanced radar training. Author (TAB)

N66-27643# TRW Systems, Redondo Beach, Calif.
RESEARCH ON ELECTRONICALLY SCANNING ANTENNAS Final Report, 26 Jan. 1965–25 Jan. 1966
D. L. Bullock and H. G. Oltman Bedford, Mass., AFCRL, Feb. 1966 88 p refs
(Contract AF 19(628)-5041)
(TRW-4390-6003-RO-000; AFCRL-66-188; AD-631488) CFSTI: HC $3.00/MF $0.75

The results of a one year theoretical and experimental investigation of the properties of a cylindrical plasma column used as a scanning microwave antenna are presented. A complete mathematical treatment is given for a new class of 'fast wave' modes for an open, cold plasma column in the absence of applied magnetic fields. Experimental results presented include antenna patterns, impedance measurements, and noise measurements. The results for different plasma operating parameters and microwave feed configurations are reported. Good agreement is obtained between experimental behavior of the antenna and the properties of the 'fast wave' modes. Most serious experimental problem is the production of homogeneous plasmas. Author (TAB)

N66-27682# Harvard Univ., Cambridge, Mass. Cruft Lab.
WAVEFORMS AND RECEIVERS FOR PULSE AMPLITUDE MODULATION
T. Berger and D. W. Tufts Sep. 1965 76 p refs
(Contract Nonr-1866(16))
(TR-488; AD-631693) CFSTI: HC $7.60/MF $0.75

Intersymbol interference, additive noise and inexact synchronization, or timing jitter, are three common sources of distortion in data transmission systems. For pulse amplitude modulation communication links, the combination of transmitter waveform and linear receiver which minimizes the overall mean square error arising from these sources is determined. Formulas are derived which permit one to explore the dependence of system performance on the data rate, the correlation properties of the data, the noise spectrum, the impulse response of the transmission medium and the probability distribution of the timing jitter. Mean square error vs. signal-to-noise ratio performance characteristics of the optimal systems are determined explicitly for several examples. These characteristics are compared both with those of certain suboptimal systems and with the optimal performance theoretically attainable (OPTA) derived from Shannon's theory of rate distortion functions. The optimal PAM systems, which can be interpreted as ideal combinations of infinite memory convolution encoders and decoders, are seen to perform very close to the OPTA for low signal-to-noise ratios. For high signal-to-noise ratios, however, the mean square error of an optimal PAM system decreases as the reciprocal of the signal-to-noise ratios, whereas the OPTA generally decreases exponentially. Accordingly, there exists a potential for realizing significant improvement at high signal-to-noise ratios by resorting to complex, nonlinear coding techniques.
Author (TAB)

N66-27800# Institute for Defense Analyses, Arlington, Va. Research and Engineering Support Div.
TIME AND FREQUENCY CHARACTERISTICS OF AN ACOUSTIC SIGNAL REFLECTED FROM A ROUGH BOUNDARY
John J. Martin Feb. 1966 53 p refs
(Contract ARPA SD-50)
(IDA/HQ-66-4568; P-243; AD-630695) CFSTI: HC $5.60/MF $0.50

This paper contains an analysis for determining the time of arrival and doppler frequency characteristics of a pulse transmitted to a target by reflection from a not-too-rough surface such as the sea bottom, and gives numerical values for a typical sonar application. The analysis may be important in sonar signal processing associated with one-way or round-trip transmission and in the interpretation of data from marine geophysical surveys; it may in addition have application to propagation of electro-mechanical waves by ionospheric refraction. Author (TAB)

N66-27833# American Meteorological Society, Boston, Mass.
SOME PROBLEMS OF RADAR MEASUREMENT OF WIND VARIATIONS IN THE TROPOSPHERE [NEKOTORYE VOPROSY IZMERENIIA PUL'SATSII VETRA V TROPOSFERE RADIOLOKATSIONNYM MITODOM]
Iu. V. Mel'nichuk Jan. 1966 14 p refs Transl. into ENGLISH from Tr. Tsentr. Aerolog. Observ. (Moscow), no. 57, 1964 p 41–48
(Contract AF 19(628)-3880)
(T-R-513; AD-630670) CFSTI: HC $1.00/MF $0.50

An apparatus for counting the number of passages through some given level by the envelope of the radar echo from a cloud of moving scatterers is examined theoretically. It is shown that the number of times the envelope passes through the average value is proportional to the root mean square of the projections of the relative or absolute speeds of the scatterers in the scattering volume onto the beam axis, depending on whether conventional or Doppler radars are used. During the investigation of wind variations, the number of these passages is proportional to the mean wind speed in the scattering volume. The effect of averaging in the scattering volume upon the energy spectrum of wind variations is also considered. Author (TAB)

N66-27839# Navy Electronics Lab., San Diego, Calif.
HF EXTENDED GROUND SYSTEMS: RESULTS OF A NUMERICAL ANALYSIS Research Report, Jun.–Nov. 1965
G. D. Bernard, W. E. Gustafson, and W. M. Chase 24 Feb. 1966 54 p refs
(NEL-1359; AD-630990) CFSTI: HC $5.80/MF $0.50

High-speed computations were made of the improvement in low-angle vertically polarized radiation obtainable with various sizes and configurations of ground systems, for various frequencies, ground constants, and elevation angles. It was shown that, in general, a ground screen of radius 250 feet produces an improvement of 3 to 9 dB on poor to fair soil (conductivity 10 millimhos per meter) at frequencies of 8 to 32 Mc/s. Improvement is greater with larger ground systems, higher frequencies, poorer soils, and at lower elevation angles. Author (TAB)

N66-27841# American Meteorological Society, Boston, Mass.
THE USE OF AN INTEGRATOR TO INCRESSE THE METEOROLOGICAL EFFICIENCY OF A RADAR [PRIMENENIE NAKOPITELIA DLIA UVELICHENIIA METEOROLOGICHESKOI EFFEKTIVNOSTI RADIOLOKATSIONNOI APPARATURY]
K. S. Zhupakhin Jan. 1966 16 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 173, 1965 p 63–70
(Contract AF 19(628)-3880)
(T-R-529, AD-630674) CFSTI: HC $1.00/MF $0.50

This paper describes the results of work with an integrator designed at the Central Aerological Observatory, USSR, to increase the sensitivity of the receiver of a weather radar. It is shown that the use of this device raises the meteorological efficiency of the radar. Author (TAB)

N66-27843# American Meterological Society, Boston, Mass.
PASSIVE-REFLECTOR EXPERIMENTS IN RADAR MEASUREMENT OF THE TURBULENCE OF THE CLEAR SKY [OPYTY RADIOLOKATSIONNOGO IZMERENIIA TURBULENTNOSTI IASNOGO NEBA S POMOSHCH'IU PASSIVNYKH OTRAZHATELEI]
G. A. Smirnova Jan. 1966 16 p refs Transl. into ENGLISH from Tr. Tsentr. Aerolog. Observ. (Moscow), no. 57, 1964 p 72–76
(Contract AF 19(628)-3880)
(T-R-517; AD-630553) CFSTI: HC $1.00/MF $0.50

Some results of radar investigation of the atmospheric turbulence of the clear sky are presented and compared with data from aircraft observations. Author (TAB)

N66-27844# American Meteorological Society, Boston, Mass.
POSSIBILITY OF RADAR DETERMINATION OF VISIBILITY IN FOGS [K VOPROSU O VOZMOZHNOSTI RADIOLOKATSIONNOGO OPREDELENIIA METEOROLOGICHESKOI DAL'NOSTI VIDIMOSTI V TUMANAKH]
G. I. Kulikova, E. G. Palagin, E. A. Poliakova, and E. M. Sal'man Jan. 1966 12 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 173, 1965 p 71–75
(Contract AF 19(628)-3880)
(T-R-534; AD-630554) CFSTI: HC $1.00/MF $0.50

The feasibility of radar determination of visibility in fogs is examined. The fundamental possibility of detection of fogs at short ranges is demonstrated. Correlations are established between optical and radar characteristics of fogs. Approaches to the development of a radar method are pointed out. Author (TAB)

N66-27858# Stanford Research Inst., Menlo Park, Calif.
HF COMMUNICATION EFFECTS: PROPAGATION IN THE HIGH-LATITUDE IONOSPHERE Final Report
T. I. Dayharsh, J. B. Lomax, W. E. Blair, P. L. Milic, E. J. Baumann et al Aug. 1965 93 p refs
(Contract DA-36-039-sc-87197)
(DASA-1700; AD-631170) CFSTI: HC $3.00/MF $0.75

The interrelationships of particular high-latitude phenomena—E_s, magnetic storms, complex ray paths, and field-aligned ionization—and HF oblique sounder observations from five paths for one year are analyzed in this report. Magnetic field deviations produced during magnetic storms were found to be highly correlated with ionospheric variations that occurred one to three hours after the magnetic variations. Equations relating the magnetic field variations to the ionospheric variations are developed in this report with generally favorable results. Prediction of E_s oblique mode occurrences and MOFs from vertical sounder data is also presented in this report. The sounder data was used to plot maps of f_oE_s and percent occurrence. Good agreement is found between the observed oblique mode statistics on four paths and those predicted from the maps. Ray-tracing techniques were used to simulate the observed oblique ray paths from vertical-incidence sounder data taken along the oblique paths. It was found that ray-tracing techniques were remarkably accurate, considering the drastic variations in ionospheric parameters along the path. Ray-tracing techniques for modes using field-aligned ionization are also presented in this report. Time delays derived by these techniques fit remarkably well with statistics for the observed scatter-modes on two paths. Author (TAB)

N66-27872# Ohio State Univ. Research Foundation, Columbus.
A PREDICTION AND TRACKING METHOD FOR SMALL-APERTURE, CONTINUOUS OPTICAL TRACKING OF ARTIFICIAL SATELLITES
Richard C. Vanderburgh Wright-Patterson AFB, Ohio, ARL, Jan. 1966 30 p refs
(Contract AF 33(615)-1915)
(ARL-66-0008; AD-631451) CFSTI: HC $2.60/MF $0.50

Field-proven prediction and tracking techniques are discussed, with their application to a 4-axis mounted 24-inch Cassegrainian telescope. Although the actual tracking performed to date has been for the purpose of photoelectric photometry of satellites, the successful techniques employed are applicable to other optical satellite tracking missions whose requirements include a large-aperture detection capability coupled with precision small-aperture continuous tracking. Emphasis is upon the efficient combination of a skilled computer-observer with inexpensive equipment, a combination which provides a wide range of versatility and flexibility. The tracking method described is, in effect, the author's practical application of a proposal by Kenneth E. Kissell presented at the COSPAR Symposium of Florence, May 1964. This investigation has been conducted in collaboration with Mr. Kissell. Author (TAB)

N66-27943*# Alaska Univ., College. Geophysical Inst.
ESTIMATED ABSORPTION OF 136 MC/S SATELLITE RADIO SIGNALS Interim Technical Report No. 1
Roy P. Basler, Harold Leinbach, and Leif Owren Feb. 1962 15 p
(Contract NAS5-1413)
(NASA-CR-75581) CFSTI: HC $1.00/MF $0.50 CSCL 17B

Typical and maximum values are estimated for ionospheric absorption for a 136 mc/s satellite radio signal observed from a station in the auroral zone at a zenith angle X. Maximum values, which apply to periods of very high solar activity and are rarely attained, are 0.8 sec X db for auroral absorption, 1.2 sec X db for polar cap absorption, and 0.25 sec X db for sudden cosmic noise absorption. More typical values are 0.3, 0.5, and negligible, respectively. Auroral absorption may change by 0.1 db/sec at 135 mc/s, and a typical event is between 20 and 30 min. During the early phase of auroral activity when auroral forms are sharply delimited, thick layers of small electron density irregularities may form and cause signal attenuation by multiple scattering. Both auroral and nonauroral absorption are discussed, as is the validity of the inverse frequency squared and secant laws. For large zenith angles the secant factor may lead to an overestimate of the expected absorption. M.W.R.

N66-27949*# Raytheon Co., Sudbury, Mass. Space and Information Systems Div.
MILLIMETER COMMUNICATION PROPAGATION PROGRAM First Quarterly Report, 1 Nov. 1964-1 Feb. 1965
[1965] 367 p refs
(Contract NAS5-9523)
(NASA-CR-75623; FR-65-40; K-625-65-1) CFSTI: HC $7.00/MF $2.00 CSCL 17B

The effects of the propagating medium on millimeter-wave (10 to 100 gigacycles) space-earth communications are described. The influence of the condition of the medium (water vapor, rain, gases, temperature, wind, etc.) on the absorption of millimeter waves, flat fading and selective frequency fading, time bandwidth product, and antenna aperture limitations are discussed. An analysis of the various waveforms required for the basic signal measurements is given; and the correlative meteorological and radiometric measurements required to establish the atmospheric condition of the atmosphere at the time the propagation measurements are made, are discussed. An experimental program is proposed the first part of which would involve the radiation of a simple modulated waveform from a 35 Gc transmitter in a 6000 mile altitude satellite which can be received by all or some combination of existing millimeter-wave ground facilities; and the second part of which would involve a ground 94 Gc transmitter that would transmit an amplitude modulated waveform to a 94 Gc receiver piggybacked upon the 35 Gc satellite transmitter. The equipment and ground facilities required for the experiment are discussed. L.S.

N66-27952*# Polytechnic Inst. of Brooklyn, N. Y.
ANALYSIS OF AN F.M. DISCRIMINATOR WITH FADING SIGNAL PLUS ADDITIVE GAUSSIAN NOISE
K. K. Clarke, Edward A. Nelson, and D. L. Schilling [1965] 15 p refs
(Grants NGR-33-008-020; NSF GP-3112)
(NASA-CR-75544) CFSTI: HC $1.00/MF $0.50 CSCL 17B

A fading signal plus additive Gaussian noise are applied to an F.M. discriminator. It is desired to compute the output signal-to-noise ratio in terms of that at the input in order to determine the effects of fading on the threshold. Author

N66-27973# Comite Consultatif International de Radiocommuncations, Geneva (Switzerland).
TECHNICAL FEASIBILITY OF DIRECT BROADCASTING FROM EARTH SATELLITES SHARING CONSIDERATIONS FOR BAND 7 AM BROADCASTING
28 Oct. 1965 15 p
(IV/138; BC/53) CFSTI: HC $1.00/MF $0.50

Minimum usable frequency, sky wave interference, noise and signal levels, and order of required power are among the factors discussed in a report which deals with sharing considerations involved in direct amplitude modulation broadcasting in band 7 from earth satellites. The discussion assumes that space service must operate with existing types of home receivers and that an operational space broadcast service would be conducted from a satellite in synchronous orbit. It is noted that the period when interference-free propagation is possible is a variable which requires examination of the kind needed for the investigation of ionosphere propagation. During the period of day when a frequency proposed for space use is also usable for normal sky wave propagation, however, wide area interference is possible. Since signal strengths, angles of arrival, and receiver characteristics do not differ appreciably for terrestrial or space service, it is concluded that existing procedures and rules are technically usable at all times. M.W.R.

N66-28028*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APOLLO UNIFIED S-BAND SYSTEM
K. E. Peltzer Apr. 1966 29 p Presented at the 1965 IEEE Intern. Electron. Symp.
(NASA-TM-X-55492; X-506-66-156) CFSTI: HC $2.00/MF $0.50 CSCL 17B

This paper describes the Apollo Unified S-Band (USB) System. The areas covered are USB station locations, uplink and downlink spectrums, ground station and spacecraft gross-parameters, general theory of operation of the system, and the functions of both the ground station and spacecraft Unified S-Band System. It is intended for those people who would like a general understanding of the USB System, but who do not intend to work in the detailed engineering phases of the program. Author

N66-28030*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INSTRUMENTATION AND FLIGHT REPORT FOR AEROBEE 150 FLIGHTS 4.122 CG AND 4.123 CG
W. D. Fortney Jul. 1965 52 p
(NASA-TM-X-55493; X-671-65-233) CFSTI: HC $3.00/MF $0.50 CSCL 09F

This report is one of a series issued by GSFC's Sounding Rocket Instrumentation Section. Pertinent engineering information is contained concerning the instrumentation, telemetry, experiment and flight results of Aerobee payloads 4.122 CG and 4.123 CG. Scientific objectives of these payloads were to collect data on celestial X-ray sources, the data to yield flux levels over a range from 0.1 to 15 Angstroms, locate sources of celestial X-rays, and measure the angular sizes of the X-ray sources. Intention of this report is to illustrate the function and performance of instrumentation and telemeter equipment supplied by GSFC's Sounding Rocket Instrumentation Section. No analysis of either scientific data or vehicle performance is presented. Author

N66-28059# Joint Publications Research Service, Washington, D. C.
SOME NEW POSSIBILITIES FOR INCREASING THE TRANSMISSION RATE OF DISCRETE INFORMATION
M. J. Pelekhatyy 16 Jun. 1966 18 p refs Transl. into ENGLISH from Elektrosvyaz (Moscow), no. 3, Mar. 1966 p 33–41
(JPRS-36028; TT-66-32462) CFSTI: $1.00

This article considers the possibility of compressing the spectrum of a random process by means of the system of linear filters used to design the Lenkurt Company's telegraph system. It is shown that there are methods of transformation that will compress spectra even further. The starting point for the method proposed is preliminary nonstatistical coding of information. Author

N66-28087# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
AN OPERATING MODEL OF A MECHANICALLY SCANNING IR-MISSILE SEEKER WITH TARGET SELECTION [UBER EIN FUNKTIONSMODELL EINES ULTRAROT-ZIELSUCHKOPFES MIT MECHANISCHER ABTASTUNG UND ZIELAUSWAHL]
Günter Kuers Apr. 1966 90 p refs In GERMAN; ENGLISH summary
(DLR-FB-66-20; DVL-450) CFSTI: HC $3.00/MF $0.75

In the first part of the present report, it is attempted to define the main functional parameters of mechanically scanning IR-missile seekers, and relate these to the minimum detectable irradiance. The second part explains the construction and characteristics of an operating model which has been designed taking into account the considerations described in the first part and which is able to carry out a suitable target selection. The results are discussed and proposals concerning the further development of the model are made. Finally, scanning systems with mechanical and electrical scanning are compared.
Author

N66-28111# Federal Aviation Agency, Atlantic City, N. J. Systems Research and Development Service.
MODERNIZED WEATHER TELETYPEWRITER COMMUNICATION SYSTEM—SYSTEM DESCRIPTION
Mar. 1966 95 p
(RD-66-21)

This document defines and describes a teletypewriter communications system designed to effect the collection and exchange of weather reports, forecasts and other related weather data on a national basis. It also provides for the exchange of data to and from overseas meteorological organizations. It is the primary digital data transfer system supporting the National Weather Services of the Weather Bureau. The Aviation Weather Services of the FAA and also provides a major support to the military weather services. This design centralizes, consolidates and automates the message switching functions of the existing weather teletypewriter Services A, C and O within the Weather Message Switching Center (WMSC). It reconfigures circuitry and reschedules data distribution to more effectively meet users requirements. The WMSC is a solid state, real time, communications type, electronic data processor operating as a centralized store and forward message switch to automatically control and perform all polling, collection, storage, selection and redistribution functions related to the handling of weather and Notices to Airmen (NOTAM) message traffic carried by the system. Author

N66-28112# Library of Congress, Washington, D. C. Aerospace Technology Div.
MATHEMATICS OF ANTENNAS—ANNOTATED BIBLIOGRAPHY Surveys of Soviet Scientific and Technical Literature
Leonas Kacinskas 31 Mar. 1966 78 p refs
(ATD-66-33)

This annotated bibliography was compiled from Soviet open sources published 1961–1964. It deals with theoretical aspects of antennas. Information is included on: radio wave diffraction determination, pencil-beam antenna, spherical antenna, antenna feeder systems, horn antenna, slot antenna, reflector-type antenna, scanning antenna, electrical beam scanning, directional antenna, aplanatic antennas, circular aperture antenna, plane aperture antenna, antenna loss determination, periscope antenna system, linear antenna, helix-dielectrical antenna, diffraction antenna, dielectric lens antenna, phase center of antennas, and dipole antenna. Author

N66-28196# Ministry of Aviation, Pinner (England). Technical Information and Library Services.
INVESTIGATIONS OF CORRELATION DISTANCE MODULATION [UNTERSUCHUNGEN ZUR KORRELATIONSABSTANDMODULATION]
W. T. Mueller Apr. 1966 20 p refs Transl. into ENGLISH from Nachrichtentechnik (E. Berlin), v. 14, no. 11, 1964 p 418–422
(TIL/T-5609) CFSTI: HC $1.00/MF $0.50

An investigation is made of the transmission of information with a common carrier of the control and information signals, i.e., using the autocorrelator for demodulation. The purpose of this study is the clarification of quantitative questions of details. Thus, the relationship between the required bandwidth of the statistical carrier, the limiting frequency of the integrating low-pass, and the maximum signalling frequency are calculated. A brief discussion is included for the design principles of a multi-channel transmission system with transit time selection. The theoretical considerations are supplemented by practical tests with a model. With this, both the associated maximum and the variation of the spectrum in dependence on the information parameters are demonstrated. C.T.C.

N66-28248# RAND Corp., Santa Monica, Calif.
QUANTIZATION NOISE IN DIGITAL MTI SYSTEMS
L. E. Brennan and I. S. Reed Mar. 1966 14 p refs
(P-3325; AD-631321) CFSTI: HC $1.60/MF $0.50

In the past, most MTI radars have used analog signal processing. With the present capability in analog-to-digital converters, digital memories and arithmetic units, it is possible to perform this processing digitally in some systems. A trend toward digital MTI processors can be expected with future improvements in digital technology. This paper deals with the effect of quantum size, or number of bits in the analog-to-digital conversion, or quantization noise in the output of an MTI processor. The correlation between quantization errors on successive pulses is considered in the analysis. This correlation has a quieting effect in some cases, reducing the output quantization noise. TAB

N66-28255# Ballistic Research Labs., Aberdeen Proving Ground, Md.
HARP 250-MC TELEMETRY EXPERIMENTS, WALLOPS ISLAND, MARCH 1965
William H. Mermagen Sep. 1965 48 p refs
(BRL-MR-1694; AD-631268) CFSTI: HC $2.00/MF $0.50

Four High Altitude Research Program (HARP) telemetry firings were conducted. Two payloads contained temperature sensing instrumentation and the remaining two contained sunsensor and accelerometer instrumentation. The temperature instrumentation was designed to measure payload compartment temperatures during flight. The sunsensor and accelerometer instruments were to give flight dynamics data. All four transmitters functioned over a portion of their flight and data were obtained on all experiments except for the accelerometers. The results of measurement are presented as well as a discussion of certain difficulties experienced. Author (TAB)

N66-28265# Radio Corp. of America, Moorestown, N. J. Missile and Surface Radar Div.
TIME BEHAVIOR OF MULTIPLE SCATTERING
B. Rosen and R. S. Ruffine Dec. 1965 34 p ref Prepared for Lincoln Lab., MIT *Its* Re-Entry Analysis Tech. Monograph No. 65-01
(Contract AF(628)-5167; ARPA Order 600; Proj. Defender)
(ESD-TDR-66-44; AD-631339) CFSTI: HC $3.60/MF $0.50

Cross-polarized electromagnetic backscatter from a cylinder of underdense plasma is considered when the input is a rf pulse of finite duration. The second Born approximation is employed. The dimensions of the scatterer are assumed large compared with the rf wavelength and the correlation distance. For times sufficiently long after the pulse has ended, the cross section is shown to fall off as the reciprocal of the time squared. An estimate is made of the effect of a nonuniform electron density and it is found that, provided the rate of decay is not too great, the cross-polarized backscatter and the directly polarized backscatter arise from the same volume of the scatterer. Author (TAB)

N66-28267# Litton Systems, Inc., Waltham, Mass. Data Systems Div.
THEORETICAL AND EMPIRICAL RESULTS ON THE CHARACTERIZATION OF UNDERSEA ACOUSTIC CHANNELS
Alan W. Ellinthorpe and Albert H. Nuttal Jun. 1965 33 p refs Presented at the 1st IEEE Ann. Comm. Conv., Boulder, Colo., 7-9 Jun. 1965
(Contracts N140(70024)71894B; N140(70024)75103B; N140(70024)76800B; Nonr-3320(00))
(TR-65-8-BF; AD-631620) CFSTI: HC $2.00/MF $0.50

An undersea acoustic link between two points in space is represented as a random time-varying linear filter. It can therefore be characterized by its impulse response, or alternately by various Fourier transforms, known as the transfer functions, spreading function, and bi-frequency function. All four of these descriptors are random functions of two variables. A generalization of the uncorrelated scattering model is proffered and it is shown how it can fit known ocean characteristics. Results are presented of some measurements made of the time and frequency spreading imposed on audio frequency transmissions over open ocean underwater paths. Most of the results deal with frequency spreading; there are fine grain time domain measurements. Results are given for several center frequencies ranging from the low hundreds to the low thousands of cycles per second. Paths between both fixed and mobile end points have been measured. The path lengths used have ranged from one-half to several hundreds of miles. The results indicate that many of the simplifying assumptions usually made in discussions of time varying channels are not satisfied by these paths, and these points where the assumptions must be generalized are briefly discussed. Author (TAB)

N66-28286# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE HAYSTACK COMPUTER CONTROL SYSTEM
Frank E. Heart, Arthur A. Mathiasen, and Paul D. Smith 27 Oct. 1965 53 p refs *Its* Tech. Rept.-406
(Contract AF 19(628)-5167)
(ESD-TDR-65-497; AD-631559) CFSTI: HC $3.00/MF $0.50

The 120-foot-diameter Haystack antenna operates at X-band and is used for satellite communications, radio astronomy, and radar astronomy. Haystack will be used to study stars, planets, the sun, the moon, and earth satellites. In order to point the antenna to within 1/10 beamwidth (22 seconds of arc) and to provide flexible control and data processing for diverse users, a digital computer has been tightly integrated into the control system. The parameters of an experiment and computer control are arranged via simple operator discourse through a keyboard/printer. The computer system can simultaneously direct the antenna, process receiver signal data, drive convenient operator displays, and permit operator discourse. Thus, processed signal data may be observed in real time, and modifications to the experiment may be rapidly implemented. The computer control system has been completed and is in full operation. Author (TAB)

N66-28297# Electro-Voice, Inc., Buchanan, Mich.
LIGHT WEIGHT AUDIO ACCESSORIES 2nd Quarterly Report, 30 Sep.-30 Dec. 1965
B. T. Cochran Apr. 1966 21 p *Its* Rept.-2
(Contract DA-28-043-AMC-01542(E))
(ECOM-01542-2; AD-631492) CFSTI: HC $1.60/MF $0.50

Work consisted of finalizing the physical configuration and proving that the weight requirements as specified have been met except for the double earphone headset which is within 11 grams of the specified weight. Author (TAB)

N66-28320# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
ADVANTAGES OF A 4-AXIS TRACKING MOUNT FOR THE PHOTOELECTRIC PHOTOMETRY OF SPACE VEHICLES
Kenneth E. Kissell Dec. 1965 48 p refs
(ARL-65-260; AD-631438) CFSTI: HC $4.60/MF $0.50

Arguments are presented for the necessity of using a four-axis telescope (Quad-R-Axial) mount for the photoelectric photometry of satellites if small field apertures and hence low sky background signals are to be achieved. Since the signal to noise ratio of the target/background is proportional to the square of the diameter of accepted field, any reduction of guiding errors which will allow smaller field apertures will then allow the photometry of fainter satellites, providing telescopes of adequate aperture are used. The improved tracking will also reduce interruptions of the light curves resulting from loss of the vehicle from the sensing aperture. The improvements possible with a QRA mount over the 2-axis (alt–azimuth) and the 3-axis (Baker–Nunn) are shown and procedures for computation of mount settings established. Photoelectric data taken with an existing 3-axis system are given for several satellites. Author (TAB)

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N66-28937# Joint Publications Research Service, Washington, D. C.
STUDIES IN ELECTRONIC COMPUTERS
29 Apr. 1966 179 p refs Transl. into ENGLISH from Elektronnyye Vychislitelnyye Mashiny (Moscow), 1965
(JPRS-35256; TT-66-31693) CFSTI: $5.00

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N66-26938# Joint Publications Research Service, Washington, D. C.
HIGH SPEED MAGNETIC, DIODE, AND TRANSISTOR LOGIC ELEMENTS WITH PERMALLOY RIBBON CORES
R. M. Lesnevskiy *In its* Studies in Electron. Computers 29 Apr. 1966 p 1–27 refs (See N66-26937 15-08) CFSTI: $5.00

The magnetic, electric, and thermal properties of thin film cores made of Permalloy were investigated. In addition, procedures were established for the mass production of these cores. It was found that the use of thin film cores in magnet–transistor and magnet–diode circuits improves the overall operating characteristics and increases the safe operating temperature range. A high frequency logical array was constructed with the following characteristics: (1) 750 kc maximum cycling frequency; (2) operating temperature range from −40° to +60°C; and (3) an allowable range variation for the transistor and diode bias voltages of ±12% and ±25% respectively. It is pointed out that the elements of array, due to the use of split winding circuits for realizing blocking and coincidence functions; are applicable as basic logic components in discrete state machines. D.T.

N66-26939# Joint Publications Research Service, Washington, D. C.
A TUNNEL-DIODE MONOVIBRATOR IN COMPUTER CIRCUITS
F. P. Galetskiy and L. A. Lyubovich *In its* Studies in Electron. Computers 29 Apr. 1966 p 28–64 refs (See N66-26937 15-08) CFSTI: $5.00

A comparison is made of monovibrators having linear and nonlinear bias. Curves are given for carrying out calculations using monovibrators and tunnel-diode resistances. It is shown that the optimum load and frequency characteristics are obtained for $\rho_1=15$. The method of carrying out calculations for logical circuits is based on both a static and a dynamic analysis. Author

N66-26942# Joint Publications Research Service, Washington, D. C.
THE BIFLUX—A NEW MAGNETIC MEMORY ELEMENT WITH FORCED WRITING REGIME AND RAPID, NON-DESTRUCTIVE READOUT
V. I. Perekatov *In its* Studies in Electron. Computers 29 Apr. 1966 p 104–114 refs (See N66-26937 15-08) CFSTI: $5.00

The article presents the results of investigation of a new magnetic element. The differentiating properties of the element are the possibility in principle of performing writing with any degree of forcing and, consequently, producing brief writing times, the absence of strict limitations placed on the variations of amplitude of writing currents, the rapid readout with no destruction of the information and the possibility of operation over a wide temperature range. Author

N66-26943# Joint Publications Research Service, Washington, D. C.
PROBLEMS OF MASS AUTOMATIC CHECKING OF FERRITE MEMORY CORES
A. A. Krupskiy *In its* Studies in Electron. Computers 29 Apr. 1966 p 115–142 refs (See N66-26937 15-08) CFSTI: $5.00

An investigation into the problems of accuracy of mass automatic checking of microminiature ferrite memory cores according to their impulse parameters. Methods for essential improvement of the accuracy (reduction in measurement error) are suggested. Recommendations are given for the selection of a system of rejection parameters, optimal sequences (programs) and parameters of switching current pulses. Author

N66-26944# Joint Publications Research Service, Washington, D. C.
THE USE OF BIAX-TYPE ELEMENTS IN OPERATIVE MEMORY

Yu. I. Vizun *In its* Studies in Electron. Computers 29 Apr. 1966 p 143–164 refs (See N66-26937 15-08) CFSTI: $5.00

The expediency of introduction of operative memory with nondestructive readout of information to computers and the selection of a biax-type core as the memory element are briefly demonstrated. The peculiarities of the design of the biax are presented, and its main characteristics are demonstrated. The general principles of construction of the magnetic portion of a memory unit based on biaxes are analysed, a basis for selection of writing and readout circuits is given and a new readout circuit developed and tested is described. Author

N66-27226*# Maryland Univ., College Park.
MAMOS: A MONITOR SYSTEM UNDER IBSYS FOR THE IBM 7090/7094
Alfred E. Beam May 1966 314 p refs
(Contract NsG-398)
(NASA-CR-488) CFSTI: HC $7.00/MF $1.75 CSCL 09B

This report describes an operating system which operates on the IBM 7090/7094 under the IBSYS or DC-IBSYS Monitor. The system processes jobs written in the MAD language, ALGOL language, FORTRAN language, and UMAP language. The processors of the system are among the fastest currently available. A very extensive library of programs is also provided. The system is especially useful for processing student jobs. Author

N66-27256# Brookhaven National Lab., Upton, N. Y.
DESCRIPTION OF THE ENDF SERVICE ROUTINES
Henry C. Honeck and Joan Felberbaum Dec. 1965 124 p ref
(Contract AT(30-2)-GEN-16)
(BNL-966(T-404)) CFSTI: HC $4.00/MF $0.75

A series of computer programs associated with the Evaluated Nuclear Data File (ENDF) at BNL are described. These routines are designated as service routines and perform simple transfers and checking of data between cards and tapes. The routines, written in Fortran II, are intended primarily for use at the ENDF Center at BNL. Author (NSA)

N66-27307*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RESEARCH IN COMPUTATIONAL MATHEMATICS AND LANGUAGES
C. L. Bradshaw *In its* Res. Achievements Rev. Ser. No. 20 1966 p 1–7 refs (See N66-27306 15-30) CFSTI: HC $2.00/MF $0.50

The problems associated with effectively relating machine languages and problem oriented language for efficient use of computers is discussed. The need for improvements in the man-machine relationship and economic improvements of trade-offs that can be achieved between presently developed machine languages to broaden the participation and usefulness of the computer in space programs is emphasized. The impact of standardization on computer utilization, the consequent reduction in redundant effort and relief from the continual need for the reformulation of the problem is shown as an important objective of the Computation Laboratory and some achievements in this area are discussed. Author

N66-27581# Illinois Univ., Urbana. Coordinated Science Lab.
CONVOLUTIONAL TRANSFORMATIONS OF BINARY SEQUENCES: BOOLEAN FUNCTIONS AND THEIR RESYNCHRONIZING PROPERTIES
Franco P. Preparata Mar. 1966 41 p refs
(Contract DA-28-043-AMC-00073(E))
(R-283; AD-630625) CFSTI: HC $2.00/MF $0.50

Non-feedback shift registers (finite-memory encoders) can be profitably adopted to perform transformations of binary sequences. The output sequence is convolutionally obtained by 'sliding' the encoding device along the input sequence and producing a symbol at each shift. Invertible transformations are characterized and decoding schemes are analyzed. The crucial point in the decoding problem is that the simply finite-memory feedback decoder presents the undesirable well-known error propagation effect, while the non-feedback decoder contains, in general, an indefinite number of stages. Finite-memory non-feedback decoding is feasible, however, if some constraint is imposed on the input sequences, or, equivalently, if some decoding error is tolerated. The analysis is conducted through the concepts of resynchronizing states of Boolean functions. The algebraic properties of resynchronizing states are carefully analyzed; it is shown that they can be assigned only in special sets, termed clusters, which form a lattice. Moreover, each cluster of resynchronizing states is possessed by a set of Boolean functions, which form a subspace of the vector space of all Boolean functions. The presented analysis provides a formal tool to relate finite-memory non-feedback decoding to the constraint imposed on the input generating source.

Author (TAB)

N66-27696# Stanford Univ., Calif. Computer Science Dept.
EIGENVECTORS OF A REAL MATRIX BY INVERSE ITERATION
J. M. Varah 8 Feb. 1966 27 p refs
(Nonr-225(37))
(CS34; AD-630998) CFSTI: HC $2.60/MF $0.50

This report contains the description and listing of an ALGOL 60 program which calculates the eigenvectors of an arbitrary real matrix, using the technique of inverse iteration. Author (TAB)

N66-27695 Rome Air Development Center, Griffiss AFB, N. Y. Research and Technology Div.
JOB LINKAGES AND PROGRAM STRINGS
Edward Morenoff and John B. Mc Lean Apr. 1966 37 p refs
(RADC-TR-66-71; AD-631513) CFSTI: HC $2.00/MF $0.50

A new technique for the communication of control and data between computer programs is described. This technique, called the program string, provides a general way by which independent programs may be dynamically linked together during their execution to do specific jobs. Presented in this paper is a description of the basic concepts, component elements, formation process, linkage mechanism and control philosophy for the execution of program strings. An essential feature of the program string concept is the introduction of buffer files between all programs to be linked. The buffer files essentially isolate the programs from each other and enable them to be operated completely asynchronously and independently of each other. The operation of the different programs is controlled by regulating the data flow between the programs at the buffer files. The automatic linking mechanism required that inputs and outputs for each program by symbolically referenced and their specifications be explicitly defined. Author (TAB)

N66-27750*# Alabama Univ., University. Bureau of Engineering Research.
A STUDY OF HIGH-SPEED AD AND DA CONVERTERS USING REDUNDANCY TECHNIQUES Interim Report, May 10, 1963–May 9, 1964
Harold Mott and Chester C. Carroll Jun. 1964 86 p refs
(Contract NAS8-5341)
(NASA-CR-75473) CFSTI: HC $3.00/MF $0.75 CSCL 09B

The results of a literature survey are presented with circuit diagrams and block diagrams of the most desirable methods of analog-to-digital conversion. Discussion of each technique explains the theory of operation and some of the problems encountered in the designs. A versatile voltage amplitude comparator is reported with suggestions for its use in all basic encoder types and with design procedures which will provide increased voltage sensitivity. To indicate further the use of the comparator, a three (3) bit encoder design is presented. The results of a reliability analysis performed on a twelve (12) bit decoder prototype are reported. Author

N66-27771# European Atomic Energy Community, Brussels, Belgium. Reactor Physics Dept.
A ONE-GROUP COLLISION PROBABILITY CODE FOR CYLINDERS AND SLABS
B. Quiquemelle 1966 38 p refs
(EUR-2624.e)

The code TIJ performs a numerical evaluation of the collision probabilities in concentric cylinders or slabs. For cell calculations several boundary conditions can be imposed, including a black inner region. Escape probabilities and Dancoff coefficients calculations are compared with other methods. The complete list of the FORTRAN program is given. Author (NSA)

N66-27848# Lincoln Lab., Mass. Inst. of Tech., Lexington.
HAYSTACK POINTING SYSTEM: CONTROL STRUCTURE
John D. Drinan and Arthur A. Mathiasen 9 Mar. 1966 156 p refs *Its* Tech. Note 1966-10
(Contract AF 19(628)-5167)
(ESD-TDR-66-154; AD-631106) CFSTI: HC $5.00/MF $1.00

The Haystack Pointing System, implemented on the Univac 490 computer, is comprised of some thirty odd subprograms which go to make up an operating system and a utility system. The domain of this memorandum is limited to the description of the control of the operating system as vested in the master control and timing programs and in the computer itself via its external and internal interrupt capabilities. In the discussion of the programmed control function are included the real-time and simulation modes of the system, the man-machine communication scheme, the experiment set-up procedures, a step by step description of the entire system cycle, the plug-in program concept as utilized in connection with the celestial computation programs and data processing programs as well as other system facets as they relate to control. Certain procedural matters which bear on the control structure are discussed. Author (TAB)

N66-27901 Mitre Corp., Bedford, Mass.
SUMMARY OF EFFORTS EXPENDED ON THE CONCEPT OF "DYNAMIC UPDATE OF A MICROFILM FILE"
George Barboza Bedford, Mass., AFSC, Electron. Systems Div., Aug. 1965 94 p refs
(Contract AF 19(628)-2390)
(TM-04024; ESD-TR-65-90; AD-620279) CFSTI: HC $3.00/MF $0.75

A description is given of the hardware developed as a feasibility prototype for a dynamically updatable microfilm information storage, retrieval, and display system. Dynamic updating is accomplished by using a magnetic strip on the microfilm in conjunction with read/write circuits. Data are stored in binary coded decimal format. 32 numerical characters of changeable information or 128 bits to each microfilm image, giving a total magnetic storage capacity of more than 300,000 bits for a 100-foot reel. A variable word length was assigned. A consecutive search capability was built to improve the retrieval response times associated with the forward-only search technique in commercial reader/retrievers. Consecutive search is defined as the capability to store the present position or frame number location on the film reel and search in either direction (i.e., forward or reverse). Logically, first-stage comparison determines the relative location of a desired frame number with respect to present position along the length of a film reel. If the reel had just been loaded, the contents of the frame counter shift register is zero. For previous requests, the contents of the frame counter shift register will be a direct indication of present position within the film reel. Three possible logical decisions are made as a result of the first stage comparison. TAB

N66-27933*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN OF COUNTUP–COUNTDOWN MACHINES
George J. Moshos (Ph.D. Thesis—Case Inst. of Tech.) 1965 164 p refs
(NASA-TM-X-57637) CFSTI: HC $5.00/MF $1.00 CSCL 09B

The design of a class of special purpose computing machines which compute by counting is systematically developed. The basis of the design philosophy is to limit the basic building elements to three fundamental units and to develop the method of synthesis such that these three building elements are represented as operational units. In particular, the three basic building elements are: (1) the binary rate multiplier which is a means of scaling down a pulse stream to some specified fraction, (2) the counter, and (3) the anti-coincidence circuit which is a means of separating pulses arriving at the counter simultaneously. The computational errors; i.e., rounding-off error and truncation error, introduced into the machines when these elements are treated as operation units are studied in detail. The method of synthesis is explicitly stated and a wide variety of machines obtained directly from this synthesis are presented. Author

N66-27942*# Space Technology Labs., Inc., Redondo Beach, Calif.
TRACKING ACCURACY MATRIX PROCESSOR (TAPP MOD III)
W. W. Lemmon 11 Dec. 1963 79 p refs
(Contract NAS7-100; JPL-950045)
(NASA-CR-75579; STL-8976-8027-RU-000) CFSTI: HC $3.00/MF $0.75 CSCL 09B

A modified Tracking Accuracy Matrix Processor computer program is discussed which extends the range and versatility of previous programs and eliminates duplication in cases involving the same trajectory and tracking noise models. Designated Mod III or TAPP III (for Tracking Accuracy Prediction Program), the new program has outputs which are specified by coded inputs in a matrix language. Also, the assumptions used to fit the data may be completely different from the true statistical model. TAPP III, which serves as a buffer between the previously-developed TAPP I and TAPP II

program, may be driven by tapes produced by tracking programs other than TAPP because no requirement are imposed on the nature of the physical constants and biases under regression. The matrix transformation techniques of TAPP III, regression to a constrained parameter set, output option controls, and coding for input systems and partitions are discussed. Flow diagrams are included. M.W.R.

N66-28060# Joint Publications Research Service, Washington, D. C.
READING MACHINES
M. L. Avrukh, A. M. Vasil'yev, G. I. Sayenko, and L. M. Sindilevich, ed. 13 Jun. 1966 279 p refs Transl. into ENGLISH of the book "Chitayushchiye Ustroystva" Moscow, 1965 p 1–204
(JPRS-35951; TT-66-32385) CFSTI: $6.00

CONTENTS:

1. PROBLEMS IN AUTOMATIC TEXT READING PROJECTS M. L. Avrukh p 1–10 refs

2. PECULIARITIES OF USING STATISTICAL CRITERIA IN AUTOMATIC READING V. P. Romanov p 11–23 refs

3. SOME PROBLEMS IN STATISTICAL PROCESSING OF PRINTED SYMBOLS USING A COMPUTER N. Ya. Birman, S. V. Kharchina, and Ye. S. Tsareva p 24–36 refs

4. A READING AUTOMATON FOR RECOGNITION OF SYMBOLS WITH RESPECT TO THE FRAGMENT METHOD L. M. Magidson and Yu. M. Sidorin p 37–41

5. A DECODER O. L. Fedorets p 42–46

6. THE SELECTION OF THE NUMBER OF GRADATIONS IN A PROBABILITY SYNTHESIS DEVICE A. D. Krisilov p 47–58 refs

7. MULTICASCADE PATTERN RECOGNITION SYSTEMS V. I. Zaytsev p 59–72 refs

8. THE APPLICATION OF LINEAR AND SPHERICAL SEPARATORS TO THE SOLUTION OF PATTERN RECOGNITION PROBLEMS S. A. Sudakov p 73–82 refs

9. THE SELECTION OF STANDARD REPRESENTATIVES OF CLASSES OF PATTERNS Ye. M. Dmitrenko p 83–91

10. THE APPLICATION OF THE CONCEPTS OF INFORMATION THEORY TO SIMPLE PROBLEMS IN PATTERN RECOGNITION A. A. Savin p 92–102 refs

11. THE USE OF PROBABILITY DISTRIBUTIONS FOR THE DESCRIPTION OF CLASSES OF PATTERNS A. A. Savin p 103–112 refs

12. THE CONSTRUCTION OF GENERALIZED SIGNS OF TWO-DIMENSIONAL PATTERNS V. M. Linkin p 113–121

13. SOME TRAINING PROCESSES IN PATTERN RECOGNITION SYSTEMS S. A. Sudakov p 122–130 refs

14. MATRIX RELIABILITY G. V. Poddubnyy p 131–151 refs

15. DETERMINATION OF THE MINIMAL DESCRIPTION OF A SYSTEM OF PATTERNS G. V. Poddubnyy p 152–165 refs

16. EVALUATION OF THE VALIDITY OF AUTOMATIC READING OF SYMBOLS IN A PRINTED TEXT V. V. Semakov p 166–175

17. SIMULATION OF A PROCEDURE FOR RECOGNITION OF HANDWRITTEN SYMBOLS V. V. Kirillov p 176–191 refs

18. RECOGNITION OF ALPHA-NUMERIC INFORMATION BY THE METHOD OF INVARIANT TRANSFORMATION V. M. Gorobtsov p 192–209

19. A LOGICAL SYSTEM FOR RECOGNITION OF SYMBOLS V. G. Komendrovskiy p 210–223 refs

20. SOME PECULARITIES OF THE CORRELATION METHOD OF PATTERN RECOGNITION V. K. Yeliseyev p 224–233 refs

21. THE USE OF DIFFERENTIAL SIGNS FOR CLASSIFICATION OF SYMBOLS V. S. Vaynshteyn p 234–239

22. THE CODE METHOD OF RECOGNITION OF VISUAL PATTERNS V. V. Buloves, L. P. Gudyalis, and A. V. Lashas p 240–243 refs

23. AN OPTICAL-ELECTRONIC CONVERTOR FOR SCANNING ALPHA-NUMERIC TEXT P. P. Yashinskas p 244–249

24. PROCEDURES FOR READING FUNCTIONS OF TWO VARIABLES IN CATHODE RAY TUBE DEVICES A. A. Budnyak and A. I. Petrenko p 250–255 refs

N66-28077# Library of Congress, Washington, D. C. Aerospace Technology Div.
COMPUTER TECHNOLOGY Surveys of Soviet Scientific and Technical Literature
Boris Doncov 17 Feb. 1966 41 p refs Compilation of abstracts
(ATD-66-19)

An annotated bibliography with abstracts is presented for digital computer technology. The following areas are included: components, design, applications, and associated systems. In addition, the use of homogeneous microelectronics computer elements and circuits to perform logic and computing operations is discussed. D.T.

N66-28150# United Kingdom Atomic Energy Authority, Harwell (England). Electronics Div.
A DISPLAY UNIT FOR COMPLEX DATA
G. C. Best Jan. 1966 20 p refs
(AERE-R-4966) HMSO: 6s

The problems which occur in the designing of a cathode ray tube display unit for complex data from nuclear reaction experiments are discussed with reference to the active zone encoder. Methods are described for a range of display operations; and techniques which extend the monitoring facility into direct data control are presented. D.T.

N66-28151# European Atomic Energy Community, Geel (Belgium). Joint Nuclear Research Center.
DIGITAL COMPARATORS FOR HANDLING OF DATA FROM NUCLEAR EXPERIMENTS
F. Colling Apr. 1966 44 p refs
(EUR-2799.e) CFSTI: HC $2.00/MF $0.50

Two digital comparators for binary or binary coded decimal information were built and tested. The comparator stages for all bits are cascaded and identical, so that they can be used as standard units in building block systems. The operation time of the 20-bit three-state transistor comparator is about 90 ns per bit for the slowest comparison. With a 10-bit window comparator, containing two two-state comparators with tunnel diodes as threshold elements, a minimum comparison speed of about 6 ns per stage (bit) was reached. This characteristic can be improved up to one order of magnitude, if necessary, when fast tunnel diodes are used. For data handling purposes two-state comparators should be preferred because of their possible simplicity and speed. A maximum flexibility in application is given, in addition,

Three state comparators, also by combination of two two-state comparators, can be used with advantage for regulation purposes as for instance gain stabilization. Author

N66-28178# Atomic Energy Establishment, Winfrith, (England). Control and Instrumentation Div.
FIFI 3: A DIGITAL COMPUTER CODE FOR THE SOLUTION OF SETS OF FIRST ORDER DIFFERENTIAL EQUATIONS AND THE ANALYSIS OF PROCESS PLANT DYNAMICS
Helen M. Sumner Nov. 1965 53 p
(AEEW-R-453) HMSO: 7s

FIFI 3 is a FORTRAN Code embodying a technique for the analysis of process plant dynamics. As such, it is essentially a tool for the integration of sets of first order ordinary differential equations, either linear or non-linear; special provision is made for the inclusion of time-delayed variables in the mathematical model of the plant. The method of integration is new and is centered on a stable multistep predictor-corrector algorithm devised by the late Mr. F. G. Chapman, of the UKAEA, Winfrith. The theory on which the Code is based and detailed rules for using it are described in Parts I and II respectively. Author

N66-28258# System Development Corp., Santa Monica, Calif.
BRACKETED CONTEXT FREE LANGUAGES Scientific Report No. 8
Seymour Ginsburg and Michael A. Harrison (Calif. Univ., Berkeley) 4 Jan. 1966 38 p refs
(Contract AF 19(628)-5166)
(TM-738/023/00; AFCRL-66-109; AD-631337) CFSTI: HC $2.00/MF $0.50

A bracketed grammar is a context free grammar in which indexed brackets are inserted around the right-hand sides of the rules. The language generated by a bracketed grammar is a bracketed language. An algebraic condition is given for one bracketed language to be a subset of another. The intersection and the difference of two bracketed languages with the same brackets and terminals are context free (although not necessarily bracketed) languages. Whether L(G1) is a subset of L(G2) and whether the intersection of L(G1) with L(G2) is empty are solvable problems for arbitrary bracketed grammars G1 and G2 with the same brackets and same terminals. Bracketed languages are shown to be codes with strong properties. Author (TAB)

N66-28268# Pacific Missile Range, Point Mugu, Calif.
"T-BOUNDS" FOR COMPUTATIONS, UPPER AND LOWER BOUNDS FOR CALCULATIONS AND DATA REDUCTION
C. J. Thorne and R. W. Claassen 1 May 1965 103 p refs
(PMR-TR-66-1; AD-631439) CFSTI: HC $3.00/MF $0.75

Basic Arithmetic: Optimum bounds are given for independent variable arithmetic operations on desk calculators or high-speed computers. These bounds are designated as "T-bounds." Efficient IBM 7094 machine language codes for these arithmetic operations are listed. Examples are included. Results for an Inverse Matrix: Bounds for the test matrix whose elements are $a_{ij}=(i+j-1)^{-1}$ are calculated for single-precision floating-point IBM 7094 arithmetic. An inviting conjecture for improved accuracy is noted. Function Routines: T-bound computer routines for the square-root, sine, cosine, arc-tangent, and exponential functions are listed and their theoretical bases discussed. Author (TAB)

N66-28273# Massachusetts Ins. of Tech., Cambridge.
INVESTIGATION OF AN ANALOG TECHNIQUE TO DECREASE PEN-TRACKING TIME IN COMPUTER DISPLAYS
William David Stratton (M.S. Thesis) Mar. 1966 74 p refs
(Contract Nonr-4102(01); Proj. MAC)
(MAC-TR-25; AD-631396) CFSTI: HC $3.00/MF $0.75

Through the use of a CRT display and a light-sensitive pen, graphical material can be directly inserted into a computer by using the pen to control the position of the electron beam at the face of the CRT—a process called pen tracking. To reduce tracking time, an analog technique employing a four-point tracking pattern is proposed in this study, in which the amplitude response of the pen to corresponding pairs of points is used to determine the position of the pen relative to the center of the pattern. To study the method, one channel of the proposed two-channel analog tracking system was designed, constructed, and coupled to the horizontal channel of the Project MAC-ESL display console. To avoid the phosphor-decay limitation, an experimental 'beam' pen capable of detecting the electron beam rather than the phosphor luminescence was employed. The system includes a pattern generator, sample-and-hold gates, difference amplifier, envelope detector and noise filter, and a threshold-logic analog-to-digital converter. Author (TAB)

N66-28287# Litton Systems, Inc., Woodland Hills, Calif. Guidance and Control Systems Div.
COMPUTERS AND DISPLAYS/CONTROLS State-of-the-Art Technology Studies, 1 Jun. 1965–31 Jan. 1966
Donald J. Pizzicara Feb. 1966 395 p refs
(Contract Nonr-4951(00))
(Publ.-4902; AD-631663) CSTI: HC $7.00/MF $1.75

Computers and Displays/Controls for avionics systems are discussed primarily from a technology standpoint. The current state of the art is reviewed, current research developments are pointed out, and prediction of when these developments will be incorporated into avionic systems is given. With respect to computers, the following major categories are assessed: (a) Logic, (b) Memory, (c) Computer Organization, and (d) Analog/Digital Conversion. Emphasis is placed on the impact of batch fabrication to these areas. With respect to Displays/Controls the following major categories are reviewed: (a) CRT's, (b) Scan Conversion, (c) Color, (d) Analog/Digital Techniques for range scaling and symbol generation, and (e) Electroluminescence. A summary chart projecting state of the art for computers and displays/controls to the 1975 period is presented at the end of the report. Author (TAB)

N66-28310# RAND Corp., Santa Monica, Calif.
COMPUTATIONAL LINGUISTICS Bibliography, 1965
David G. Hays, Bozena Henisz-Dostert, and Marjorie L. Rapp Apr. 1966 81 p refs
(Contract AF 49(638)-700)
(RM-4986-PR; AD-630985) CFSTI: HC $3.00/MF $0.75

A bibliography citing 700 U.S. foreign articles, reports, and books relevant to the fields of computational linguistics and documentation. A selective coverage of classification theory, computation and programming, computers, and hardware, non-numerical applications of computers, and psycholinguistics is included. In the area of linguistics, the editors have taken a broad view of structural theory and semantics. Author (TAB)

N66-28322# Ballistic Research Labs., Aberdeen Proving Ground, Md. Ballistic Measurements Lab.
NOTE ON COMPUTER PROGRAM FOR THE SINGLE CAMERA ORIENTATION CASE
Lila M. Butler Sep. 1965 19 p refs Addend. to BRL-1268 (BRL-MR-1702; BRL-1268; AD-630786) CFSTI: HC $1.60/MF $0.50

This report presents an addendum to Ballistic Research Laboratories Report No. 1268, Computer Program for the "Single Camera Orientation" case of the General Problem of Photogrammetry. A new method for the computation of the mean errors of unit weight for the plate and point coordinates as developed by H. H. Schmid is the main modification to the existing method of computation. Author (TAB)

N66-28354# Iowa State Univ. of Science and Technology, Ames. Ames Lab.
DIAN—A SYSTEM FOR PROGRAMMING A DIGITAL COMPUTER IN TERMS OF ANALOG COMPONENTS
G. J. Farris and L. E. Burkhart 1 Nov. 1965 84 p (Contract W-7405-ENG-82) (IS-1225)

DIAN (Digital–ANalog) is a programming system by which a digital computer may be programmed in a manner very similar to the technique of programming an analog computer. The system is compatible with the Fortran symbolic language and may be used as part of a larger digital computer program. It may be applied to the more general types of boundary-value problems arising in process simulation, to the initial value problems ordinarily solved on analog computers, to nonlinear problems, and to control problems involving large transport delays. The system may be used to simulate a very large analog computer or it may be considered to be a separate technique of problem solution with its own unique features. Author (NSA)

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N66-26941# Joint Publications Research Service, Washington, D. C.
ON THE CONTROL OF A NARROW P^+N JUNCTION BY THE FIELD OF AN INSULATED ELECTRODE
V. N. Pyrchenkov *In its* Studies in Electron. Computers 29 Apr. 1966 p 91–103 refs (See N66-26937 15-08) CFSTI: $5.00

A one-dimensional analytical model for metal oxide semiconductor systems was used to investigate a device in which the p-n junction was controlled by a potential on an insulated electrode. This work was performed to establish, on the basis of available experimental data, the possibility that internal field emission is fundamental to the operation of such a device. A preliminary estimate was made of the voltage in order to create the necessary and sufficient conditions for tunneling through the barrier in the p-n junction; and the total system was partially idealized with the aid of energy diagrams for a clear representation of the basic processes taking place within the device. However, it is noted, since it is difficult to interpret the operation of the device simply by a one-dimensional model, a bulk energy diagram was also used to aid the analysis. D.T.

N66-27038*# Westinghouse Electric Corp., Baltimore, Md. Electronics Div.
CIRCUITS AND CIRCUIT TESTING FOR SPACEBORNE REDUNDANT DIGITAL SYSTEMS Special Technical Report No. 3
H. Brinker and A. R. Helland Sep. 1963 92 p refs (Contract NASw-572) (NASA-CR-55424) CFSTI: HC $3.00/MF $0.75 CSCL 09A

This report describes the results of the study on the implementation of majority logic redundancy. Most of the work concerns spaceborne systems, but some portions are more applicable to ground support equipment. The report is concerned with the initial design of the system as well as the testing of redundant systems. The possible use of magnetic logic to reduce the total power consumption and provide nonvolatile storage is discussed. Magnetics seems to be most useful for non-volatile memory and simple forms of logic where the data rate is very low. Various types of semiconductor logic are described and compared for use in redundant systems. Integrated diode-transistor logic elements are chosen as the most suitable for general use. Several methods of testing redundant systems are discussed and described in the section on detection and location of failures. Author

N66-27159# United Kingdom Atomic Energy Authority, Culham (England).
DEVELOPMENT OF FAST 100-kV, I-MA, SOLID DIELECTRIC SWITCHES AND ASSOCIATED TRIGGERING STUDIES
T. E. James, K. Harries, and R. D. Medford *In* Calif. Univ. Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res. [1965] p 77–90 refs (See N66-27148 15-25) CFSTI: HC $6.00/MF $1.25

Experiments were conducted on fast solid dielectric switches with high triggering currents and insulation thicknesses, and the results indicate that similar switches operating at voltages up to about 500 kV can be triggered satisfactorily. A breakdown mechanism is proposed which agrees reasonably well with the experimental results, and enables the breakdown time to be calculated for any triggering current waveform and insulation thickness. The edges of the switch plates are molded in epoxy resin or silicone rubber to prevent surface flashover along the polyethylene insulation. The main current arc strikes on the walls of a 1-inch diameter hole or recess in the electrodes and is maintained there by its own magnetic pressure, thus preventing erosion of the electrode surface adjacent to the main insulation. The burnt polyethylene and other combustion products are expelled though the 1-inch hole by pressure buildup in the opposite recess, and into a container outside the switch which also acts as an effective silencer. High current tests are still being conducted to fully assess the maximum current and coulomb ratings of the electrode configuration and to check its suitability for use at currents above 1 MA lasting for about 300 μsec. L.S.

N66-27212*# Marine Engineering Lab., Annapolis, Md.
SOLID-STATE CIRCUIT DEVELOPMENT
P. P. M. Liwski Apr. 1965 24 p (NASA-CR-75380; MEL-283/64; AD-462281) CFSTI: HC $1.00/MF $0.50 CSCL 09A

Final design changes are reported for a silver–cadmium battery sensing and switching circuit developed for satellite electric power systems. This circuit is designed to continuously monitor the terminal voltages of an active and a standby battery and the individual cell voltages in the active battery. When minimum voltage conditions are met, the circuit switches electrical load from the active to the standby battery. This circuit also allows solar cells, when energized, to supply load current and battery charging current. Also described is a circuit designed to control the charge current into recently developed nickel–cadmium cells with control electrodes ("three-terminal" cells). The potential on the control electrode of a cell is the input signal to this circuit which, in turn, determines when and how the charge current is to be changed. Author

N66-27408# International Resistance Co., Philadelphia, Pa. Documented Reliability Div.
PRODUCTION ENGINEERING MEASURES FOR HIGH RELIABILITY, FIXED, FILM, PRECISION RESISTORS Final Engineering Report
Richard C. Wagner 30 Nov. 1965 328 p Sect. I
(Contract DA-36-039-AMC-01461(E))
(AD-631935) CFSTI: HC $7.00/MF $1.50

CONTENTS: Policy and objectives; employment and training administrative organizations; documentation; calibration control system; incoming inspection; in-process control; special processes; final quality control acceptance; stamp control; nonconforming material; customer returned material; exhibits. TAB

N66-27431# Midland-Wright, Kansas City, Kans.
PRODUCTION ENGINEERING MEASURE, RELIABLE QUARTZ CRYSTAL MICROELEMENTS, TYPES EL-MCRO1 (X-1) AND EL-MCRO2 (X-1) Quarterly Progress Reports, 13 Jan.–29 Sep. 1965
Stuart Radetsky [1965] 26 p ref
(Contract DA-36-039-AMC-03639E)
(QPR-1; QPR-2; QPR-3; AD-630710) CFSTI: HC $2.00/MF $0.50

A combination plater–sealer unit with two evacuation chambers has been built. Vacuums less than 1-micron in the plater chamber and 10-microns in the sealer chamber have been obtained. Successful resonator plate designs have been developed in three of the six frequencies required. TAB

N66-27637*# Atomics International, Canoga Park, Calif.
INVESTIGATION OF CURRENT DEGRADATION PHENOMENON IN SUPERCONDUCTING SOLENOIDS Third Quarterly Progress Report, 15 Jan.–15 Apr. 1965
L. C. Salter, Jr. [1965] 9 p ref
(Contract NAS8-5356)
(NASA-CR-75382) CFSTI: HC $1.00/MF $0.50 CSCL 09A

Supercurrent stability of heat treated Ti-22 at.% Nb wire samples was investigated. The measurement consists of testing a short wire sample, carrying a dc current, for super-to-normal transitions in a time varying magnetic field. Results show that the Ti-22 at.% Nb alloy is a stable superconductor, regardless of the heat treatment, for all values of critical current densities and for the maximum field conditions used. This high degree of stability, and high current densities and upper critical fields, make the alloy a potentially excellent material for use in high field superconducting solenoids. These superior properties are the result of weak flux spinning sites which allow flux to flow through the superconductor without catastrophic SN transitions. R.N.A.

N66-27579# SFD Labs., Inc., Union, N. J.
DEVELOPMENT OF AN X-BAND CW CROSSED-FIELD AMPLIFIER Ninth Interim Development Report, 28 Jun.–28 Dec. 1965
J. Hentschel Mar. 1966 46 p refs
(Contract NObsr-89503)
(SFD-33-IDR-9; AD-630597) CFSTI: HC $4.60/MF $0.50

A thermally improved helix coupled vane circuit (HCV) has been scaled for use over the 7 Gc to 11 Gc frequency range. Interaction impedance measurements verify the rapid increase in this parameter with decreased beta and point toward improved operation at lower frequencies. When operated in the conventional manner, a narrow band version of the circuit has operated with 20 db of net gain with a 20 watt peak drive signal but with only 8% efficiency. (Microsecond pulses were used for all tests.) The first test of a reentrant injected beam crossed-field amplifier has resulted in a substantial reduction of all power parameters. With this technique, 10 db of net gain has been measured with the extremely low peak drive signal of 25 mw. Author (TAB)

N66-27600# National Co., Inc., Melrose, Mass.
PRODUCTION ENGINEERING MEASURE FOR CESIUM BEAM TUBES Quarterly Progress Report, 23 May–23 Aug. 1965
James George 23 Aug. 1965 21 p
(Contract DA-36-039-AMC-01457)
(QPR-9; AD-630565) CFSTI: HC $1.00/MF $0.50

Life testing to date of the retrofitted PEM-E3 cesium beam tube has yielded satisfactory results. Results of the evaluation of the retrofitted PEM-E5 and PEM-E6 cesium beam tubes indicate that the redesigned cesium oven corrects the beam-regulation and oven-input-power requirement problems and that the redesigned cesium detector corrects the signal-to-noise ratio problem. Author (TAB)

N66-27607# Martin Co., Baltimore, Md.
RADIATION EFFECTS ON INSULATED GATE FIELD EFFECT (MOS) INTEGRATED CIRCUITS Second Quarterly Progress Report, 1 Oct.–31 Dec. 1965
David M. Long and C. Y. Wrigley (Sprague Elec. Co.) Fort Monmouth, N. J., Army Electron. Command, Apr. 1966 39 p
(Contract DA-28-043-AMC-01520(E))
(ECOM-01520-2; AD-631266) CFSTI: HC $3.60/MF $0.50

A shielded exposure box was constructed to reduce charge scattering and leakage currents in the flash X-ray instrumentation circuitry. The box reduced the response of the instrumentation circuitry by about an order of magnitude to levels less than 10 microamps. The theoretical analysis involved the investigation of damage mechanisms for the threshold voltage of MOS devices. Order-of-magnitude estimates and qualitative arguments are used to consider the effects of ionization, atomic displacements, and charge scattering. The primary damage mechanism is tentatively identified as the sweeping out of ionization-induced electrons from the oxide by electric fields in the oxide. The construction of P-enhancement and N-depletion devices is discussed, as are the techniques for accomplishing controlled variations of manufacturing parameters on selected devices. TAB

N66-27621# Weston Instruments, Inc., Newark, N. J.
STUDY OF ELECTROLUMINESCENT DISPLAY TECHNIQUES AND EVALUATION OF A THIN FILM CROSS-GRID DISPLAY PANEL Final Technical Report, Aug. 1964–Sep. 1965

T. K. Lakshmanan and I. Munt Wright-Patterson AFB, Ohio, AMRL, Dec. 1965 53 p refs
(Contract AF 33(615)-1876)
(AMRL-TR-65-166; AD-631465) CFSTI: HC $3.00/MF $0.50

A study was conducted of the state-of-the-art of electroluminescent display techniques applicable to simulation of on-board displays of future vehicles and displaying computer and/or video information for use in training devices. An evaluation was made of the various fabrication techniques to determine the one with greatest potential for producing a high resolution, bright cross-grid type panel display. A thin film cross-grid panel, 9 in. × 9 in. with 258 × 258 lines was fabricated and evaluated to determine operational characteristics and limitations. Some basic considerations were given to driving electronics to determine designs for maximum flexibility for computer generated inputs. Author (TAB)

N66-27628# Army Electronics Labs., Fort Monmouth, N. J.
HIGH-POWER S-BAND POWER DIVIDER
Robert M. True Mar. 1966 27 p
(ECOM-2685; AD-631809) CFSTI: HC $2.00/MF $0.50

This report describes the design, construction, evaluation, and use of a high-power, S-band, waveguide power divider. This device exhibits a power-handling capability of 500 kilowatts peak and 500 watts average, and has a dynamic range greater than 36 db. The need for such a power divider arose when it became necessary to examine the behavior of the experimental circulator at various intermediate power levels. The major design features and construction details are discussed, and evaluation of test data is presented. Author (TAB)

N66-27663# Syracuse Univ., N. Y. Dept. of Electrical Engineering.
RESPONSE OF HIGH-Q, TUNED CIRCUITS TO STEP INPUTS IN FREQUENCY, PHASE, AND AMPLITUDE
James G. Harris Griffiss AFB, N. Y., RADC, Apr. 1966 39 p refs
(Contract AF 30(602)-3649)
(TR-66-1; RADC-TR-66-191; AD-631678) CFSTI: HC $2.00/MF $0.50

A mathematical analysis of the response of a high-Q tuned circuit to input steps in frequency, phase and amplitude is presented. Laplace transform techniques are used to determine the electrical performance of a generalized RLC resonant circuit and conditions necessary to eliminate transient current effects are derived. Two examples illustrate the circuit response to FSK and PSK types of transition.
Author (TAB)

N66-27668# Army Electronics Labs., Fort Monmouth, N. J.
DESIGN, FABRICATION AND EVALUATION OF THIN-FILM AMPLIFIERS
Herbert C. Frankel Mar. 1966 43 p refs
(ECOM-2687; AD-631803) CFSTI: HC $2.00/MF $0.50

The report describes the design, fabrication, and evaluation of two versions of a thin film hybrid amplifier. The amplifier uses a two stage, RC coupled, common emitter circuit originally designed to provide 40 dB voltage gain in a 455 kc i.f. application. The thin film versions include eight nichrome resistors and five aluminum electrode–silicon monoxide dielectric capacitors. In the first thin film version, produced on a 3 in. × 1 in. glass slide, two of the capacitors, nominally 0.1 μF each, were made by multilayering electrode and dielectric films alternately. The second version, produced on both sides of a 3/4 in. glass square, utilizes a single 500 Å dielectric layer in each 0.1 μF capacitor. Author (TAB)

N66-27669# Philco Corp., Lansdale, Pa.
LOW COST INTEGRATED CIRCUIT TECHNIQUES Second Quarterly Progress Report, 15 Sep.–14 Dec. 1965
Sturger Wagner and Mauro Walker Ft. Monmouth, N. J., Army Electron Command, Apr. 1966 68 p refs *Its* Rept.-2
(Contract DA-28-043-AMC-01424(E))
(ECOM-01424-2; AD-631491) CFSTI: HC $6.60/MF $0.75

Both the evaporated and pyrolytic glass deposition techniques have been improved, resulting in encapsulating deposits of higher quality. The pinhole problem associated with the evaporated glass has been nearly eliminated. Also, improved adherence has been obtained with the pyrolytically deposited glass. Glass delineation was improved by using an improved fixture for evaporation though a metal mask. Some improvement was also made in the delineation of pyrolytically deposited glass. In the work on glass evaluation techniques, a method involving pressurized steam has proven to be effective in the relative evaluation of the passivating properties of glass. Also, mobile charge concentration studies were performed on both evaporated and pyrolytically deposited glass. Problems encountered in metalization include increased ohmic contact resistance and poor delineation. Some test models have been produced, although device and metal delineation problems have delayed the completion of the vehicles. The vehicles have been subjected to preliminary electrical and environmental evaluation. A plan for the testing and specification of the preliminary exploratory development models was prepared. Author (TAB)

N66-27690# Radio Corp. of America, Camden, N. J. Communications Systems Div.
MODULES (INTEGRATED CIRCUITS) FOR COMMUNICATIONS Third Quarterly Report, 1 Jul.–30 Sep. 1965
F. E. Farmer, A. M. Hoque, and H. Groot Apr. 1966 45 p *Its* Rept.-3
(Contract DA-28-043-AMC-00454(E))
(ECOM-00454-3; AD-631603) CFSTI: HC $4.60/MF $0.50

Two integrated circuits were evaluated, the Philco PA-713 and the RCA TA-5112. The final design selected for the lin-log 60-megacycle i-f amplifier was a synchronously tuned amplifier using the successive detection and summation technique with a delay line and using the RCA TA-5112 integrated circuit in a differential configuration as the basis for the design. Author (TAB)

N66-27692# Radio Corp. of America, Princeton, N. J.
THIN-FILM POLYCRYSTALLINE FIELD-EFFECT TRIODE Third Quarterly Report, 1 Jan.–31 Mar. 1966
Paul K. Weimer, Harold Borkan, Jeffrey J. Bowe, Verne L. Frantz, Robert S. Hopkins, Jr. et al Ft. Monmouth, N. J., Army Electron. Command, Jun. 1965 56 p refs
(Contract DA-28-043-AMC-00231(E))
(QR-3; AD-631408)

A process for fabricating CDSE thin-film-transistors (TFT's) reproducibly in large arrays has been developed. The deposition of the semiconductor by evaporation upon an unheated substrate is controlled by means of electrical monitoring of a sample TFT deposited on the same blank with the circuit array, wire grill masks in the vacuum system are used to define the patterns. Integrated thin-film circuits incorporating 540 CDSE TFT's have operated continuously for more than 500 hours without failure. The hall mobility and resistivity of vacuum-deposited CDSE films have been studied for various deposition conditions. Metal-insulator-semiconductor (M-I-S) structures have been used to study instability

mechanisms in the TFT. A systematic program of fabrication and life-testing of CDS TFT's is being carried out. Analog and digital circuits incorporating TFT's were studied. Masks were designed and ordered for a three-input digital gate. Author (TAB)

N66-27693# Bendix Corp., Baltimore, Md. Radio Div.
THIN FILM MICROCIRCUIT INTERCONNECTIONS Second Quarterly Interim Report, 1 Oct.–31 Dec. 1965
Harold M. Greenhouse, Robert T. Galla, Ira G. Goldsmith, Theodore H. Yaffe, Winfield W. Richardson et al Mar. 1966 103 p refs *Its* Rept.-2
(Contract DA-28-043-AMC-01482(E))
(ECOM-01482-2; AD-631412) CFSTI: HC $4.00/MF $0.75

Process specifications for the deposition of chromium, silicon-monoxide and tantalum–aluminum were established. Adhesion tests of chromium–gold, chromium and aluminum thin films to glass substrates were completed. All interfacial interconnection combinations were fabricated, and D.C. measurements yielded an order-of-magnitude value for their D.C. interfacial resistance. Infrared photography was evaluated as a non-destructive test for the quality of thin film interconnections, and it was found to be not very useful. A new interfacial interconnection pattern is proposed which will make possible precise quantitative values for the interfacial resistance. Insulating crossover combinations were fabricated using silicon-monoxide as the dielectric, at various thicknesses from 2700 Å to 27,000 Å. No correlation between capacitance and breakdown was found. Asymmetrical voltage breakdown was investigated and none was found to exist. An automatic tester for breakdown voltage determinations is being designed. Author (TAB)

N66-27696# Army Electronics Labs., Fort Monmouth, N. J.
COMPUTER-AIDED ANALYSIS OF A SILICON MONOLITHIC INTEGRATED CURRENT SWITCH GATE
William V. Bell, Joseph E. Kernan, Jr., and Paul H. Holub Mar. 1966 28 p refs
(ECOM-2683; AD-631657) CFSTI: HC $2.00/MF $0.50

In the d.c. design of large signal non-saturating-type logic circuits, it has been possible to develop a set of worst case defining equations which take into account all external and internal parameter variations; such as resistor, voltage tolerances and certain transistor parameters. An example of how a computer solves the problem of specifying allowable noise immunity of a current switch gate (C.S.G.) under worst-case static conditions is illustrated in this report. Author (TAB)

N66-27700# Radio Corp. of America, Princeton, N. J.
THIN-FILM POLYCRYSTALLINE FIELD-EFFECT TRIODE Quarterly Report, 1 Apr.–30 Jun. 1965
Paul K. Weimer, Jeffrey J. Bowe, William H. Laznovsky, Angarain G. Sadasiv, Robert L. Schelhorn et al Ft. Monmouth, N. J., Army Electron. Command, Sep. 1965 41 p refs *Its* Rept.-4
(Contract DA-28-043-AMC-00231(E))
(QR-4; AD-631409) CFSTI: HC $2.00/MF $0.50

A process of stabilizing cadmium sulfide TFT's has been developed. Preliminary data based on 1000-hour shelf-life and operating-life tests indicate that the stabilized TFT's do not have the reversible gate insulator-semiconductor instability. Shelf life and operating life have revealed that random I_D instabilities have been greatly reduced. From early operating life-test comparisons, the long-term decay observed in previous TFT's has also been greatly reduced. Operating tests of units at 130°C and 185°C for 300-hour periods indicate the presence of a long-term decay mechanism. Integrated thin-film three-input gate circuits incorporating CdS TFT's and Nichrome resistors have been fabricated and tested. A procedure for depositing CdSe TFT's upon an unheated substrate has yielded good reproducibility, stability, and life. An unencapsulated circuit incorporating 540 CdSe TFT's was operated over 2000 hours at room temperature before any units failed. Another circuit of the same type has operated 700 hours at 85°C without failure. Author (TAB)

N66-27714# Sonotone Corp., Elmsford, N. Y.
STANDARD LINE-BATTERY ASSEMBLY BB-610( )/U NICKEL CADMIUM VENTED First Quarterly Report, 25 Jun.–28 Oct. 1965
John Herrmann, Arthur Fitchman, and Raymond Nathe Ft. Monmouth, N. J., Army Electron. Command, Mar. 1966 31 p
(Contract DA-28-043-AMC-01508(E))
(ECOM-01508-1; AD-631271) CFSTI: HC $2.60/MF $0.50

The report covers the research and development activities which have been directed towards the design of a 12-volt, vented, nickel–cadmium battery housed in a reinforced-fiberglass container and capable of surviving four-foot, free-fall drops. Essentially, the structural system consists of a steel inner box which clamps a bank of 10 cells to make a rigid assembly. This assembly, in turn, is hardmounted within a reinforced fiberglass outer box to cause its walls to be preloaded in tension. This preload tends to reduce the magnitude of compressive loads induced by impact. Author (TAB)

N66-27717# Ballistic Research Labs., Aberdeen Proving Ground, Md.
EVALUATION OF A TUNNEL-DIODE OSCILLATOR FOR USE IN GUN PROBE TELEMETRY
James W. Evans Nov. 1965 28 p refs
(BRL-Memo-1711; AD-631514) CFSTI: HC $2.00/MF $0.50

A 1750 mc/s tunnel-diode oscillator for use as a UHF telemetry transmitter in high velocity gun launched projectiles is described. The results of performance tests under high acceleration conditions are discussed. Performance deficiencies are noted. Because of the recent developments in high frequency transistors and current availability of transistor oscillators with power outputs of 100 to 500 milliwatts at 1750 mc/s, it is not planned to continue the work on tunnel oscillators. TAB

N66-27721# Sylvania Electric Products, Inc., Mountain View, Calif. Electronic Defense Labs.
THE EXTENSION OF DYNAMIC RANGE AND FREQUENCY COVERAGE IN SOLID-STATE AMPLIFIERS AND MIXERS
David M. Hodsdon 30 Nov. 1965 94 p refs
(Contract DA-28-043-AMC-00379(E))
(EDL-M871; AD-631347) CFSTI: HC $3.00/MF $0.75

Investigations were made to increase the dynamic range and frequency coverage of solid-state vhf receivers. The following aspects are considered: (1) a theoretical and experimental comparison is made between a field-effect transistor and a conventional transistor amplifier in respect to intermodulation distortion and noise figure; (2) balanced amplifiers with feedback are considered for improving dynamic range; (3) the phase and amplitude criteria at the frequency crossover of partitioned amplifiers are investigated; and (4) experimental data are presented on a doubly balanced mixer, a logarithmic amplifier, and a voltage-tuned filter covering from 850 to 900 mc. Author (TAB)

N66-27725# General Electric Co., Auburn, N. Y. Semiconductor Products Dept.

A PRODUCT ENGINEERING MEASURE FOR THE IMPROVEMENT OF PRODUCTION TECHNIQUES TO INCREASE THE RELIABILITY AND TO IMPROVE PRODUCT CAPABILITY OF HIGH VOLTAGE MINIATURE SILICON RECTIFIERS Quarterly Progress Report, 30 Sep.–30 Dec. 1965

W. R. Comstock, P. C. Whitman, R. R. Schall, and E. G. Tefft [1965] 69 p refs

(Contract DA-36-039-AMC-06157(E))

(QPR-4; AD-631364) CFSTI: HC $3.00/MF $0.75

The work performed includes: evaluation of pellet design experiments performed during the last quarter; adoption of a final pellet design; installation of production equipment and start-up of the manufacturing line; completion of A13 matrix testing through the 2,000-hour readout; design of the A14 life test matrix; finalization of the proposed specification, except for reverse recovery testing; and presentation of environmental and life test data for devices fabricated during the third quarter. Author (TAB)

N66-27809# Varian Associates, Beverly, Mass. Bomac Div.

PRODUCTION ENGINEERING MEASURE FOR LOW FIELD MAGNETRON BL-234C Quarterly Progress Report, 28 Oct. 1965–28 Jan. 1966

Arnold M. Eklund [1966] 39 p

(Contract DA-36-039-AMC-06162(E))

(QPR-3; AD-631122) CFSTI: HC $3.60/MF $0.50

The second group of engineering tubes, Tube Nos. 6S through 10S, have shown significant improvement in performance over the first group of tubes. In general, 400 watts peak output power was exceeded in all tubes with considerably broader operating voltage mode widths. Operating life improved by a factor of more than 2 to 1 with tube 6S reaching 74 hours before pulse instabilities exceeded specified limits. An extended vacuum, bakeout, and activation procedure has been initiated during this period that will make, in all probability, 100 hours operating life readily achievable. Two cathode types have been processed in tubes using this procedure, the Bomac nickel matrix and the Spectra-mat directly heated tungsten dispenser, and initial life test results show promise. Receipt of the tungsten carbide modified broaches has been realized, and completion of the evaluation of conventionally machined modes is now expected near the beginning of the next quarter. Some difficulties have been encountered in obtaining π mode resonance within the specified frequency range from anodes obtained from the next hob. The previous hob, from which four of the five tubes of the second group of engineering tubes were obtained, failed after a total of 68 pushes. Completion of rework of the Government furnished vacuum system has been delayed due to problems associated with flange and valve leaks in the ultra high vacuum portion of the system. Bell jar vacuum has exceeded 4×10^{-6} mm Hg, which is more than adequate for tube envelope vacuum during extended temperature bakeout. Author (TAB)

N66-27818# Naval Civil Engineering Lab., Port Hueneme, Calif.

CURRENT-VOLTAGE CHARACTERISTICS OF THIN-FILM DIODES Technical Report, Mar.–Jun. 1966

R. D. Hitchcock Mar. 1966 40 p refs

(R-435; AD-630587) CFSTI: HC $2.00/MF $0.50

The current-voltage (I-V) characteristics of thin-film diodes were measured at 4.2°K, 77°K, and room temperature. Superconductive tunneling was achieved with a diode consisting of aluminum, aluminum oxide, and lead ($Al/Al_2O_3/Pb$). In the nonsuperconducting state the $Al/Al_2O_3/Pb$ type of thin-film diode exhibited Zener breakdown between 1.5 and 3.5 volts. However, the $Al/Al_2O_3/Pb$ diodes did not have reproducible I-V characteristics, and the nonsuperconducting $Al/Al_2O_3/Pb$ diode could not be operated with AC voltage long enough to serve as a practical electronic device. A thin-film diode consisting of aluminum, aluminum oxide, manganese, and lead exhibited power-law I-V characteristics at ambient temperatures, under 60-cycle excitation, and could be operated with a reproducible I-V characteristics for several hours. Bistable switching was achieved with a thin-film diode consisting of aluminum, aluminum, aluminum oxide, lead, and aluminum; in this diode the short-circuit state was produced by a high-voltage pulse and the open-circuit state by a low-voltage pulse. A theoretical analysis of the observed I-V characteristic is presented. Author (TAB)

N66-27825# George Washington Univ., Washington, D. C. Center for Measurement Science.

TWO-PORT NETWORK PARAMETERS OF THE PIEZOELECTRIC SEMICONDUCTOR ELECTROACOUSTIC AMPLIFIER

Robert M. Moore and Louis de Pian 28 Feb. 1966 158 p refs

(Contract Nonr-761(09))

(Rept.-5; AD-631035) CFSTI: HC $15.40/MF $1.00

The electroacoustic amplifier utilizes electron acoustic interactions in piezoelectric semiconductors. The device has promise as a possible high intensity acoustic source at frequencies in the range where present generation techniques (e.g., high harmonic operation of quartz devices) are of limited utility, and as an amplifier or delay line at microwave frequencies. Its characteristics as a two port network are extremely important. The basic properties of the electron-acoustic interaction are developed and the characteristics of the primary forward and reverse waves are formulated in terms of the electron drift velocity. These results are used, together with the appropriate boundary conditions, to evaluate the two-port network parameters of the electro-acoustic amplifier. Using these network parameters, it is shown that criteria can be developed for the existence of undamped acoustic oscillations, and for the occurrence of activity when the device is employed for amplification or delay line application. Author (TAB)

N66-27842# TRW Semiconductors, Inc., Lawndale, Calif. Engineering Dept.

PRODUCTION ENGINEERING MEASURE RELIABILITY THROUGH PROCESS IMPROVEMENT (EXTENSION TO 2N2525 TRANSISTOR FAMILY Final Report, 1 Mar.–31 Oct. 1965

A. R. Brand and B. H. Wiley [1965] 82 p refs

(Contract DA-36-039-SC-86742(E))

(AD-630784) CFSTI: HC $1.00/MF $0.50

Process improvement work was conducted to obtain a silicon triple diffused transistor based on type 2N2525 with a maximum operating failure rate of 0.01% per one thousand hours at a 90% confidence level at 25°C. Successful improvements were made in the flange-to-ceramic bonding, metallizing, feed-through pin seal, die attachment, and final closure. A thorough understanding of metal to ceramic interface was gained. The performance of the package summarized

as follows: (1) Hermeticity is very good and unaffected by high temperatures and environmental testing. (2) The overall mechanical strength of the package is very good in every respect, with the possible exception of the ultimate strength of the BeO ceramic. At present work is in progress to increase its strength to equal that of aluminum oxide ceramics. (3) Cold weld capping yields exceed 95%, thus having great promise for future production. (4) Heat dissipation is extremely good. TAB

N66-27847# Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
HIGH SPEED SEMICONDUCTOR SWITCH (TWO TERMINAL) AND HIGH SPEED SEMICONDUCTOR SWITCH (GATE) Tenth Quarterly Report, 29 Aug.–28 Nov. 1965
B. G. Burlingame 28 Nov. 1965 46 p
(Contract DA-36-039-AMC-01475(E))
(AD-631064) CFSTI: HC $2.00/MF $0.50

Activities included the evaluation of a process change designed to increase dv/dt capabilities, evaluation of turn-on time methods and characteristics of the two-terminal device, preparation of revised specifications for both two- and three-terminal device types, and the preparation of test procedures. Test facilities for preproduction lots were completed, and work was started on production life test equipment for the two- and three-terminal device types as well as the type 2N1765 which is being produced by Motorola as a consideration for specification and schedule revisions. Author (TAB)

N66-27857# CTS Corp., Elkhart, Ind. Research and Development Div.
PRODUCTION ENGINEERING MEASURE FOR SUBMINIATURE, TRANSISTOR TYPE POTENTIOMETERS Quarterly Progress Report, 1 Oct.–31 Dec. 1965
C. L. Holmes and D. C. Kinsey 31 Dec. 1965 12 p
(Contract DA-36-039-SC-85976)
(QPR-18; AD-631050) CFSTI: HC $1.00/MF $0.50

A total of 300 subminiature potentiometers were fabricated for retesting on rotational life and moisture resistance. Technical Action Request No. 9 was submitted to obtain approval of the moisutre resistance test equipment at CTS of Berne, Berne, Indiana. After approval of the test facility was obtained, 100 potentiometers of the 50 ohm bushing mount style and 100 of the 50 ohm flat mount style were placed on the moisture resistance test. The 100, 25,000 ohm bushing mount controls were submitted to rotational life test. Author (TAB)

N66-27874# IIT Industrial Labs., Fort Wayne, Ind.
RESEARCH INVESTIGATIONS ON SMOOTHING ELECTRON MULTIPLIER FOR ELECTRONIC-SCANNED IMAGE TUBE Final Report
James L. Gimnick and R. A. Harber 5 Feb. 1965 67 p refs
(Contract N123-(62738)35257A(X))
(AD-630711) CFSTI: HC $3.00/MF $0.75

The object is to improve the signal-to-noise ratio obtainable in an image dissector type camera tube. The desired performance specifications are given below as a direct excerpt from the proposal request. The smoothing principle has been demonstrated experimentally and good agreement between the theoretical analysis and experiment has been found. The smoothing feature has been demonstrated using a phosphor–photocathode smoothing element. Both periodic and random electron pulses have been applied to the phosphor–photocathode sandwich. This was done by feeding periodic voltage pulses from a conventional electronic pulse generator or random pulses generated in a multiplier phototube to the grid of a CRT containing the phosphor element of the sandwich. Photographs of the scope display showing the output improvements of the phosphor–photocathode smoothing sandwich were made. Extensive measurements of the noise voltage preceding and following the smoothing device were also made in order to compare theory and experiments. The agreement of these experimental results with theory are felt to be very good. TAB

N66-27879# Hamilton Standard Div., United Aircraft Corp., Broad Brook, Conn.
MICROBONDS FOR HYBRID MICROCIRCUITS Quarterly Progress Report No. 6, May–Jul. 1965
P. R. Amlinger and S. L. Sherman 6 Apr. 1966 69 p refs
(Contract DA-36-039-AMC-03742(E))
(HSER-3133; ECOM-03742-6; AD-631288) CFSTI: HC $3.00/MF $0.75

The overall objective of the program is development of reliable high yield processes for bonding fine wires of gold and aluminum to gold–chromium and aluminum films on various substrates such as alumina, sapphire, and oxidized silicon. The reliability goal of a maximum expected failure rate of 3 bonds per 1000 at a 90% confidence level was demonstrated for type H microbonds (0.001 inch gold wire resistance welded to gold–chromium film on oxidized silicon). Preliminary bonding of riser wires to edge terminations of Ni/Au/Cr films on (as-fired) alumina (type V microbonds) was initiated. It was found that use of gold-plated copper matrices resulted in low mean pull strength. A survey of available flap-pack lead material and multilayer circuit boards was started. Sample welds made with a parallel-gap resistance welder were investigated but no conclusions could be drawn. The investigation of flip-chip bonding, was continued on a limited basis. However, the preliminary results using a soldering technique indicated the bonds were not as reliable as desired and that other bonding techniques such as ultrasonic bonding should be investigated. TAB

N66-27885# TRW Semiconductors, Inc., Lawndale, Calif. Research and Development Dept.
TRANSISTOR, VHF, SILICON, POWER TYPE EL-2N (X-9) 5W 500 Mc PEM Quarterly Report, 1 Aug.–31 Oct. 1965
R. Clarke, J. Crishal, J. Rice, P. Risinger, and W. Weisenberger [1965] 58 p
(Contract DA-36-039-AMC-06163(E))
(QR-2; AD-631522) CFSTI: HC $3.00/MF $0.50

Classification of finished units continues by the reactive diode sputtering while RF dielectric sputtering equipment is being prepared for sputtering of wafers as well as finished units. The six-leaded butterfly glassified-molded package yields the best performance with the simplest assembly. Two cell and complete four cell devices of the four emitter patterns with each of the two metallized patterns have been examined for optimum performance leading to the final design. The first engineering samples produced 5 to 6 dB of power gain with 35 to 45% efficiency at 28 V. The second engineering samples produced 5 to 6.5 dB of power gain with 50 to 55% efficiency at 28 V. From this data the final interrupted emitter device was prepared at the 10 watt level. In addition, an interdigitated device was also prepared for comparison at the 10 watt level. Preliminary results on the interdigitated device are 5 to 7.5 dB with 40 to 70% efficiency at 28 V. The final interrupted emitter device is currently being processed. Author (TAB)

N66-27859# Mallory (P. R.) and Co., Inc., Indianapolis, Ind.
PRODUCTION ENGINEERING MEASURE FOR IMPROVED RELIABILITY OF SOLID ELECTROLYTE TANTALUM CAPACITORS Quarterly Report, Sep. 30–Dec. 29, 1965
A. W. H. Smith [1965] 12 p refs
(Contract DA-36-039-AMC-03623(E))
(QR-10; AD-630694) CFSTI: HC $1.00/MF $0.50

5,249 capacitors are now on 85°C life test. All the Group B and D tests are in progress. With only one failure recorded, a total of 8.8×10^6 unit hours of 85° C life test was accumulated. At 60% confidence, this represents a 0.025% per 1000 hours failure rate. TAB

N66-27945*# ITT Industrial Labs., Fort Wayne, Ind.
RESEARCH IN THE DEVELOPMENT EFFORT ON AN IMPROVED MULTIPLIER PHOTOTUBE Sixth Quarterly Report
F. H. Barr and E. H. Eberhardt 30 Mar. 1966 25 p refs
(Contract NASw-1038)
(NASA-CR-75610; ITTIL-66-1018) CFSTI: HC $1.00/MF $0.50 CSCL 09A

The dark current and dark counting characteristics of the FW-130 (S-20 cathode) series of photomultiplier tubes were investigated by cooling both the tube and the photocathode. The cooling equipment was adapted in order to insure a low overall noise level and to provide the ability to monitor the cathode temperatures. Different modes of multiplier operation were also tried to determine their effect on total photomultiplier noise. It is shown from the data analysis that a reasonable correlation is obtained between the photocathode dark current density and the photocathode dark count density. In addition, it was found that the dark current was not as temperature sensitive as was expected. Since the mechanism responsible for this behavior is unknown, further investigation of the S-20 cathode characteristics in particular, is recommended. D.T.

N66-27958*# Texas Instruments, Inc., Dallas. Materials and Controls Div.
THE DEVELOPMENT OF A STANDARD FOR MULTILAYER PRINTED CIRCUIT BOARDS BY MEANS OF RESEARCH, DEVELOPMENT, AND TESTING Final Report
15 Nov. 1965 37 p
(Contract NAS8-11712)
(NASA-CR-75572; TI-04-65-38) CFSTI: HC $2.00/MF $0.50 CSCL 09A

Over eighty potential test sample suppliers of electronic circuit boards were surveyed by questionaire in an effort to determine processing limitations used in the industry with respect to the conductor sizes, spacing, and process control capability. The information was used to develop a test sample pattern and standard for a multilayer printed circuit board designed to be as compatible as possible with all the various multilayer printed circuit board fabrication processes in use, while at the same time taxing them and positively identifying their basic capabilities and critical limitations. A total of 85 circuit boards received from nine manufacturers, each using a different layer-to-layer interconnection technique, were tested environmentally (vibration, mechanical shock, etc.) and for their material characteristics (impedance, current capacity, voltage breakdown, weldability, lamination bond strength, repairability, internal temperature rise, etc.). The manufacturer's circuit boards were categorized into four basic through-connection technologies: (1) plated hole, (2) solid pin, (3) eyelet, and (4) build-up pillar. Results regarding the producibility and durability of the connections with respect to diameter size, test parameters, and material characteristics are presented graphically and are discussed. L.S.

N66-27976# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
VIBRATION AND SHOCK TESTING OF MULTILAYER PRINTED WIRING BOARDS
A. Koudounaris May 1966 65 p refs
(SM-49159)

This report covers the vibration and shock test results and procedures which comprised one phase of the multilayer printed wiring board development program. Sample multilayer boards, with and without flatpacks, were subjected to vibration and shock testing preceded by temperature cycling and shock; these tests were followed by high altitude testing. The boards were subjected to the most rigorous vibration and shock conditions likely to be encountered by electronic assemblies in a manned launch vehicle. There were no through-hole or welded lead connection failures. There was one soldered lead connection failure. Author

N66-28245# Physics Lab., RVO-TNO, The Hague (Netherlands). Dept. for Digital Computing Techniques.
APPLICATION OF FIELD-EFFECT TRANSISTORS IN DIGITAL CIRCUITS (PART 2) [TOEPASSING VAN FIELD EFFECT TRANSISTOREN IN DIGITALE SCHAKELINGEN (DEEL 2)]
Nov. 1965 28 p refs In DUTCH; ENGLISH summary
(TDCK-45099; PH.L.1965-40) CFSTI: HC $2.00/MF $0.50

In this report a survey is given of the characteristics of a number of enhancement-type M.O.S. field-effect transistors. Particular emphasis has been laid on the applicability in basic digital circuits. A design-method for digital systems, containing both p- and n-type M.O.S. field-effect transistors is outlined. The results, obtained in the course of this investigation, have underlined the potential advantages of field-effect transistors over conventional transistors. However, using discrete field-effect transistors, fairly large numbers are needed in many cases to build digital systems. This will probably restrain the field-effect transistors from a real breakthrough until they become commonly available in the form of integrated circuits. Author

N66-28262# Hughes Aircraft Co., Fullerton, Calif.
RADIATION EFFECTS ON (MONOLITHIC) MICROELECTRONIC CIRCUITS Third Quarterly Report, Nov. 1965–31 Jan. 1966
C. W. Perkins, R. W. Marshall, E. P. Mitchell, and A. M. Liebschutz Ft. Monmouth, N. J., Army Electron. Command, May 1966 56 p refs
(Contract DA-28-043-AMC-01313(E))
(FR-66-17-57; ECOM-01313-3; AD-631705) CFSTI: HC $3.00/MF $0.50

Phase I was completed during the third quarter with the circuit evaluation for permanent damage as determined in the pulsed reactor tests. The results of these tests show that the RCTL circuits are more susceptible to neutron damage than the RTL and DTL circuits. This is because the manufacturers of the RCTL circuits use triple-diffused planar techniques for the transistor structure rather than the planar epitaxial techniques employed in the RTL and DTL circuits. In addition smaller geometry and gold-doping are used in the latter. RTL and DTL circuits fail at a neutron influence above 10^{14} nvt, in general, while the RCTL circuits fail at an order of magnitude lower. Author (TAB)

N66-28300# Library of Congress, Washington, D. C. Aerospace Technology Div.
CHICOM STATE-OF-THE-ART IN ELECTRONICS AREA Surveys of Chinese Communist Scientific and Technical Literature

14 Jan. 1966 16 p refs Compilation of Abstracts
(ATD-66-6; TT-66-61094; AD-631546) CFSTI: HC $1.00/MF $0.50

This compilation of abstracts is based on CHICOM open sources published 1964–1965. It is the first report in a series. The fifteen abstracts are arranged alphabatically by author. The following information is included: ammonia maser, semiconductor developments, radio transmitter, TV transmitter, calcium tungstate crystal, neodymium-containing laser, pulse laser, continuous-wave laser, subminiature radio direction finder, miniature electron tube, pentode electron tube, tunnel diode, atmospheric propagation, antenna, short wave backscatter sounding, oscillator tube, audiofrequency carrier telegraph transmitter, teletypewriter, and carrier-wave telephone. A list of 7 Chinese journals searched in compiling the report is provided. There is no bibliography.
Author (TAB)

N66-28377*# Space Craft, Inc., Huntsville, Ala.
PREMODULATION FILTERS Final Report
Apr. 1966 17 p
(Contract NAS9-4393)
(NASA-CR-65376) CFSTI: HC $1.00/MF $0.50 CSCL 09A

Due to the requirement for an isolated input, a signal reconstruction technique was used in the design of the premodulation filters. This method permits the filters to handle a dc signal with transformer coupling, and also provides good noise rejection. The basic operation principles of each subcircuit and its function in the overall circuit are explained; these include the voltage regulator, dc to dc inverter, input buffer, toggled flip-flop, filter circuits, and output buffers. To eliminate ground-loop problems, separate ground leads were provided from the various circuits to the ground pin of the connector. Experiments with the breadboard model indicate that lowering the high frequency response of the output buffers would decrease the noise fed into the output buffers via the supply voltages. Schematics of the circuitry and of the 800 bit/sec premodulation filter are included. M.G.J.

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N66-28826# Stanford Univ., Calif. Systems Theory Lab.
ON RECIPROCITY IN LINEAR TIME-INVARIANT NETWORKS
B. D. O. Anderson and R. W. Newcomb Nov. 1965 21 p refs
Its Tech. Rept.-6558-3
(Grant NSF GK-237)
(SEL-65-101)

A general time-domain definition of reciprocity is given in terms of network port variables, and this definition is applied to conclude the symmetry of network matrices, even in the case of active, nonfinite networks. A new proof is presented of the reciprocity of finite networks composed of time-invariant resistors, capacitors, inductors and transformers, and this proof is also applied to show the reciprocity of interconnections of a wide class of reciprocal networks. Author

N66-28871# Joint Publications Research Service, Washington, D. C.
THE LAPLACE–GALU TRANSFORMATION IN THE THEORY OF SEQUENTIAL DEVICES
Ya. Z. Tsypkin and R. C. Faradzhev 26 May 1966 10 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 166, no. 3 [1965] p 570–573
(JPRS-35705; TT-66-32140) CFSTI: $1.00

Concepts of lattice Boolean functions are introduced which take on values from a finite Galu field and their discrete Laplace transforms; based on these concepts, a theory of sequential devices is constructed analogous to the theory of impulse systems. Forward and inverse Laplace–Galu transforms are defined for establishing basic theorems on the correspondence between operations on the original and reflected functions. Nine theorems are summarized; eight make it possible to establish the operations on the reflections corresponding to those performed in the domain of the originals. Other than linear operations, all others are expressed by convolution in the reflected domain or by conjunction in the original domain. The ninth theorem is useful in problems relating to the transformation of cyclical phenomena. A class of linear sequential devices is considered. Expansion formulas are given, together with their generalization to the cases of multiple zeros of the characteristic polynomial, arbitrary input functions, etc., for determining the forced and transient processes (including zero sequences) in the device. M.G.J.

N66-27033*# Westinghouse Electric Corp., Baltimore, Md. Surface Div.
RESEARCH ON FAILURE FREE SYSTEMS Final Report
H. Brinker et al Dec. 1963 249 p refs
(Contract NASw-572)
(NASA-CR-56686; WGD-38521) CFSTI: HC $6.00/MF $1.50 CSCL 09C

Design objectives that permit the proper operation of systems to be relatively independent of the effects of individual component or module failures within systems are studied. The scope of the study includes both the use of the more conventional techniques of multiple-line, majority voted redundancy as well as the study of self-repair and advanced voting techniques. M.P.G.

N66-27198*# Westinghouse Electric Corp., Baltimore, Md.
RESEARCH ON FAILURE FREE SYSTEMS WITH SUPPLEMENTAL INFORMATION Final Report
Dec. 1963 225 p refs
(Contract NASw-572)
(NASA-CR-57011) CFSTI: HC $6.00/MF $1.25 CSCL 09C

The implementation studies as part of the research on failure free systems are concerned with efficient initial design and the diagnostic testing of multiple-line, majority logic redundant systems. Several techniques are described for detecting and locating failures within an operating redundant system, and a method for prediction of mission reliability is discussed. In the study of advanced voting techniques, the Adaline–Neuron adaptive voter with continuously variable input weighting, the Transor restoring circuit, and the Hamming Distance restoring circuit were investigated. The third portion of the research on failure free systems is devoted to the study of self-repair techniques. Using these techniques, a system may be designed to absorb more internal failures without system failure. A computer simulation program is described which is used to compare the effectiveness of various switching strategies employed in self-repairing systems. D.S.G.

N66-27210*# National Aeronautics and Space Administration, Washington, D. C.

CALCULATING THE PERFORMANCE RELIABILITY OF SYSTEMS CONTAINING A LARGE NUMBER OF ELEMENTS [O METODAKH RASCHETA NADEZHNOSTI RABOTY SISTEM, SODERZHASHCHIKH BOL'SHOYE CHISLO ELEMENTOV]

Y. I. Siforov Nov. 1963 16 p Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekh. Nauk (Moscow), no. 6, 1954 p 3–12

(NASA-TT-F-8705) CFSTI: HC $1.00/MF $0.50 CSCL 09C

An effort was made to find a quantitative ratio between the probability of damage to an entire system and the probable damage to its individual components, in an attempt to calculate the performance reliability of systems containing a large number of elements. Included were the general ratios between the probabilities of damage to the system and to its elements, the duration of the system's operation without damage, an analysis of various methods of replacing the system's elements, and methods of designing systems with an automatic replacement of the elements. C.L.W.

N66-27320*# Tennessee Univ., Knoxville. Dept. of Electrical Engineering.

ON MINIMUM FUEL AND ENERGY CONTROL OF SAMPLED-DATA CONTROL SYSTEMS Scientific Report No. 12

A. M. Revington and J. C. Hung 30 May 1966 310 p refs (Grant NsG-351)

(NASA-CR-75407) CFSTI: HC $7.00/MF $1.75 CSCL 09C

In examining the problem of nonlinear control of sampled data systems, only pulse amplitude modulated systems were considered. Saturation in the minimum energy and minimum fuel deadbeat regulator was also studied, in order to provide practical implementation of the optimal control in a feedback structure. The dynamic systems (plants) are described by linear constant coefficient differential equations. The theory of the linear energy and fuel problems is developed for the first and second order systems, with the properties of the optimum input sequence considered for first order plants. Saturation in the minimum energy problem is also discussed, and it is shown that the open loop reduces to finding which members of the control sequence equal the saturation limit, ±1. The corresponding minimum fuel problem is also considered; first and second order systems are solved for both. Ways of implementing the optimal strategies are suggested, and it is pointed out that in certain cases very simple optimal and suboptimal strategies can be realized. Supporting data are also included on sampled data systems and invariant vectors, and on the derivation of the equations used. M.G.J.

N66-27655# Northrop Corp., Newbury Park, Calif. Nortronics Applied Research Dept.

GENERALIZED MODEL FOR SEMICONDUCTOR RADIATION RESPONSE PREDICTION Third Quarterly Progress Report, 15 Jun.–15 Sep. 1965

James P. Raymond, William W. Chang, and Robert E. Johnson [1965] 90 p refs

(Contract DA-28-043-AMC-00423(E))

(NARD-65-18R; ECOM-00423-3; AD-631387) CFSTI: HC $3.60/MF $0.75

Work was primarily analytical and devoted to the characterization of the 'second-order' effects which significantly influence the transient response of practical transistors. Previously, the lumped-model technique was applied to the one-dimensional diffusion models of the junction diode and transistor. It was assumed in all cases that the lumped model parameters were independent of the junction bias voltages and terminal currents. There are three serious deviations from the 'ideal' model in a practical transistor: the two-dimensional nature of the base region, the variation of the transistor current gain with emitter current, and the electric field effects induced in the high-resistivity collector region. The lumped-model technique was used to extend the transistor model to include all three effects. Author (TAB)

N66-27671# Rome Air Development Center, Griffiss AFB, N. Y. Advanced Studies Group.

TIDES: A TIME-DIVISION ELECTRONIC SWITCHING SYSTEM USING INTEGRATED CONTROL

Allan A. Kunze Mar. 1966 82 p refs

(RADC-TR-65-70; AD-631478) CFSTI: HC $3.00/MF $0.75

A military circuit switching system must have the ability to handle emergency situations in which a large percentage of its circuits are simultaneously active. In devising schemes to implement switching systems, private industry recognizes this situation to the extent of providing rapid, sophisticated common control equipment to process calls. It appears, however, that insufficient attention has been given to integrating the call processing functions with the more elementary crosspoint control functions, with the aim of creating an 'integrated switching module.' This module would stand virtually on its own, containing switching matrix, crosspoint control logic, and call processing logic. Implementation of a circuit switching system then would consist of interconnecting the requisite number of modules. This report describes the integrated switching module, and details the operation of the module and of a suggested circuit switching system containing several such modules. Included are discussions of some important system features and their impact on the basic approach, such as: conference calls, hot line operation, long distance switching, saturation signaling, and other supervisory and monitoring capabilities incorporating call transfer, change of address, and trunk hunting. Author (TAB)

N66-27863# California Univ., Berkeley. Dept. of Mathematics.

CONTINUOUS OPTIMAL CONTROL PROBLEMS WITH PHASE SPACE CONSTRAINTS

Jane Cullum Dec. 1965 101 p refs

(Contract Nonr-222(88))

(AD-630568) CFSTI: HC $10.60/MF $0.75

The first part is devoted to proving that for a control problem satisfying the proper differentiability hypotheses and in which the optimization is made over a set of trajectories of the associated differential system that are in a fixed closed subset A of E^n, if an optimal solution exists such that the optimal trajectory is on the boundary of A and such that in a neighborhood of this trajectory, the boundary of A is the C^2-diffeomorphic image of an open set in E^{n-1}, then this optimal solution satisfies a modified version of Pontryagin's maximum principle. The proof presented is direct and uses only the constructions used in the proof of Pontryagin's principle. If a C^2-diffeomorphism exists, it is proved that the problems considered by Gamkrelidze are included in the problems considered in this paper. The restriction made by Gamkrelidze that the controls be piecewise smooth is removed, and the condition that the control sets be regular is relaxed. In the second part, three types of approximations of sequences of trajectories paired with their controls to a trajectory and its control are defined. The first type involves only the convergence of the trajectories, the second and third types add the convergence of the corresponding controls in the weak L^2-topology and the strong L^2-topology respectively. Next penalty functions are introduced

and the problems generated perturbed; it is proved that the preceding results still hold for this new family of problems. Finally, results involving controllability hypotheses are obtained, and a specialized theorem involving approximations of type three is proved. TAB

N66-27876# Systems Technology, Inc., Hawthorne, Calif.
INVESTIGATIONS OF DESCRIBING FUNCTION TECHNIQUE Final Report, 15 Jan.–Nov. 1964
Dunstan Graham and Lee Gregor Hofmann Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Feb. 1966 111 p refs (Contract AF 33(615)-1474)
(AFFDL-TR-65-137; AD-631314) CFSTI: HC $11.60/MF $0.75

Three problems were chosen so as to explore some of the apparent limitations of describing function technique for the analysis of nonlinear systems, and to show how the technique might be extended so as to overcome the indicated deficiencies. The problems were (1) the effects of stick and valve friction in fully powered, manual aircraft control systems, (2) limit cycles in satellite attitude control with off-on jets, and (3) the effects of aerodynamic hysteresis in the stability derivatives of tilt-wing VTOL aircraft. The results indicate that new describing functions can be developed as closed-loop functions provided that specific restrictions are met, that non-sinusoidal, Fourier series describing functions or a generalized periodic input describing function can be successful, but that they are extraordinarily difficult to apply, and that the aerodynamic nonlinearities which were considered are of small practical importance. Author (TAB)

N66-27961*# Case Inst. of Tech., Cleveland, Ohio. Digital Systems Lab.
A COMPENSATED PULSE-DATA RELAY SERVOMECHANISM
William Doyle Mc Leod [1965] 152 p refs (Grant NsG-36-60)
(NASA-CR-75578; EDC-1-65-32) CFSTI: HC $5.00/MF $1.00 CSCL 09C

A means of retaining the full information content in a quantized variable by use of a high frequency dither is developed. This dither signal does not involve adding a dither to the input to the quantizer and consequently the quantizer circuitry is not required to process information at high rates so that reliability of the digital portion of the control loop is maintained. This technique also makes it possible to obtain a resolution which is smaller than the quanta size. This method of quantization is combined with a relay control element in a digital feedback system. The relay is effectively linearized by a high frequency dither. This provides the capability of satisfying a wide range of performance specifications and eliminates some of the stability problems normally associated with digital systems. Author

N66-27963*# Alabama Univ., University. Dept. of Electrical Engineering.
A DEVELOPMENT OF THE DESCRIBING FUNCTIONS FOR TWO NONLINEARITIES SEPARATED BY A LINEAR FUNCTION Final Report, 1 Sep. 1965–1 Feb. 1966
R. E. Lueg 15 May 1966 20 p refs (Grant NsG-381)
(NASA-CR-75533) CFSTI: HC $1.00/MF $0.50 CSCL 09C

The use of describing functions in analyzing a system containing two nonlinearities of dead zone and backlash, separated by a linear block is examined in a sample problem. Describing functions plots for such systems in which various values for the dead zone half-width, the hysteresis width, and the input amplitude are substituted are presented, and should be of definite aid to control system engineers confronted with analyzing such systems. The describing function can be obtained if the parameters are known. The technique can also be used in obtaining the describing function of many other nonlinear–linear combinations, and work of this nature is planned for the future. L.S.

N66-27981# Joint Publications Research Service, Washington, D. C.
ON THE SYNTHESIS OF NONLINEAR CONTROL LAWS
R. A. Nelepin 3 Jun. 1966 9 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 166, no. 6, 1966 p 1312–1314
(JPRS-35827; TT-66-32281) CFSTI: $1.00

A precise analytical solution is examined for an automatic system of the nth order which requires the introduction of nonlinear control laws. Equations are given for the synthesis of nonlinear control for the system, the required transformation is made, and the problem is reduced to that of a 2nd order system which can be solved by using a phase plane. The method presented is considered to have application to the control of motion in cases where high accuracy is required. M.W.R.

N66-28043*# Research Triangle Inst., Durham, N. C.
DEVELOPMENT OF RELIABILITY METHODOLOGY FOR SYSTEMS ENGINEERING. VOLUME II: APPLICATION—DESIGN RELIABILITY ANALYSIS OF A 250 VOLT-AMPERE STATIC INVERTER Final Report
C. D. Parker and A. C. Nelson Apr. 1966 222 p refs (Contract NASw-905)
(NASA-CR-75671) CFSTI: HC $6.00/MF $1.25 CSCL 14D

This report describes the application of design stage reliability analyses to a static inverter, emphasizing the use of improved analytical techniques as a supplement, but not a substitute, to conventional analyses. Models are used to relate the important performance characteristics to the factors that influence their variation. As a means to achieving the most reliable design within practical constraints, emphasis is on identifying and implementing design improvements rather than on obtaining a number to represent reliability. Performance variation analyses, reliability prediction, component stress analyses, and failure modes and effects analyses individually contribute to reliability; however, it is through the proper coordination of these tasks and appropriate combination and interpretation of their results that the earliest assurance for reliable design is achieved. Several significant design problems were detected with this approach that conventional analysis could overlook. Author

N66-28049# Joint Publications Research Service, Washington, D. C.
ASYMPTOTIC OPTIMAL SYSTEMS AS A MODEL OF THE PROCESS OF TEACHING CONTROL
Yu. P. Leonov 3 Jun. 1966 9 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 167, no. 3, 1966 p 538–539
(JPRS-35821; TT-66-32255) CFSTI: $1.00

Consideration is given to asymptotic optimal systems as a model of the process of teaching control. It is assumed that an object with the coordinate Y_n is controlled with the signal X_n, both signals being a discrete function of time. The objec

is statistical, so that at $[X_n]=[x_n]$, (where $[x_n]$=the realization of the random functions), the output signal is a random function. C.T.C.

N66-28134# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati.
DYNAMIC BEHAVIOUR OF TUNNEL DIODE MONOSTABLE CIRCUITS [COMPORTAMENTO DINAMICO DEI CIRCUITI MONOSTABILI A DIODO TUNNEL]
M. Coli, N. Abbattista, and V. L. Plantamura (Bari Univ.) 8 Mar. 1966 21 p refs In ITALIAN; ENGLISH summary *Its* Nota Interna No. 311
(LNF-66/12) CFSTI: HC $1.00/MF $0.50

The dynamic behavior of monostable, tunnel diode circuits was analyzed as a function of the circuit's characteristics parameters. Particular emphasis was placed on circuits with current gain greater than one and on circuits performing only one logic operation in high speed nuclear electronics applications. Also, circuits with near peak tunnel biasing were investigated for multiple switching stability. D.T.

N66-28187# Polish Academy of Sciences, Warsaw.
THE ANALYSIS AND SYNTHESIS OF THE SYSTEM FOR THE ELECTROMAGNET CURRENT STABILIZATION WITH THE AMPLIDYNE AS THE SOURCE OF CURRENT AND THE SELECTIVE FEEDBACK CIRCUIT IN THE LAST STAGE OF THE AMPLIFIER [ANALIZA I SYNTEZA UKLADU DO STABILIZACJI PRADU, ZASILAJACEGO ELEKTROMAGNES, Z AMPLIDYNA JAKO ZRODLEM PRADU ORAZ ODSPRZEZENIEM RESONANSOWYM W STOPNIU KONCOWYM WZMACNIACZA]
Zygmunt Burzynski 1965 87 p refs In POLISH; ENGLISH summary
(INR-639/III/E) CFSTI: HC $3.00/MF $0.75

It is shown in the dissertation, with the aid of the analysis, that the electromagnet current stabilization circuits with the amplidyne as the source of current and the chopper voltage error amplifier, need the synthesis for the used amplifications on the basis of the required stabilization. The synthesis depends on theoretical determination from the transmittance of corrected open circuit, the selective feedback parameters in the last stage of the amplifier, in order to receive the stabilized loop without essential reduction of the frequency band passed by the open circuit. The general form of the open system transfer function is given in the fractured form. To simplify interpretation of logarithmic diagrams all factors are of first and second order. Author

N66-28195# Atomic Energy Establishment, Winfrith (England). Control and Instrumentation Div.
DIGITAL METHODS APPLIED TO REDUNDANT AUTOCONTROLLERS FOR PLANT
L. A. J. Lawrence and A. B. Keats Dec. 1965 37 p refs
(AEEW-M-603)

Redundancy techniques applied to autocontrol systems using analog methods are well established and have been well proven in use. The paper discusses the significant features of a "majority-force" redundant autocontrol system, in which failed subsystems are prevented from disturbing the plant controlled variable by a significant amount by being overpowered by the correctly functioning subsystems. After briefly describing the salient features of an established majority-force system using analog circuit techniques, the paper goes on to describe an equivalent system using digital circuit techniques. The digital system possesses self-monitoring characteristics and yields an output signal which is designed to feed a stepping motor. Author

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N66-27148# Oak Ridge National Lab., Tenn.
AN UNCONVENTIONAL ULTRAHIGH-VACUUM FACILITY
E. R. Wells *In* Calif. Univ. Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res. [1965] p 7-9 (See N66-27146 15-25) CFSTI: HC $6.00/MF $1.25

To provide pressures of 10^{-10} torr, a CTR subsidiary experiment, a vacuum vessel 2 ft in diameter and 8 ft long was fabricated and tested. Pumping was provided by conventional 6-in NRC diffusion pumps. Conventional water-cooled, chevron-type baffles provided the only oil trapping between system and pumps. All valves were eliminated, and seals were compression-type aluminum wire gaskets. Inside the stainless vessel was a copper liner heated during pumpdown to 100°C. Observations over several months of continuous pumping at static pressures of 5×10^{-9} torr revealed no visible traces of oil backstreaming from the pumps. Batch evaporation of Ti onto the liquid-nitrogen-cooled walls of the inner liner decreased the pressure approximately two orders of magnitude. Thermal cycling of the wall temperatures produced no measurable pressure change. A residual gas analyzer was placed on the system to indicate pressures below 5×10^{-10} torr and to measure the relative magnitude of the various mass peaks. Only small traces of the usual hydrocarbons were found; the predominant mass peak was 28. Increasing the pump heater power by 50% produced no increase in the mass 28 peak, indicating a low level of silicon contamination in the system. Author

N66-27155# California Univ., Livermore. Lawrence Radiation Lab.
RELIABILITY OF THE ASTRON ACCELERATOR
K. A. Saunders *In its* Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res. [1965] p 48-51 (See N66-27146 15-25) CFSTI: HC $6.00/MF $1.25

The reliability of the Astron accelerator is considered as a function of only those components directly related to the production of the electron beam. The method of acquiring and processing the data is presented. This data is reduced to show reliability and ease of maintenance for each of the major component categories as well as for the system. This information is also carried on to show the system availability for the average conditions of past operation. The present reliability figures are compared with previous predictions. To add insight into future operation, an attempt is made to predict the system availability at varying stress levels of voltage and pulse repetition rate. Author

N66-27157# California Univ., Berkeley. Lawrence Radiation Lab.
ELECTROLYTIC CAPACITOR BANKS

Donald B. Hopkins *In its* Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res. [1965] p 63–67 refs (See N66-27146 15-25) CFSTI: HC $6.00/MF $1.25

A series string of electrolytic capacitors has been proven to be a reliable energy-storage unit. Electrolytic capacitor banks have been providing magnetic field energy for Berkeley rotating plasma experiments since 1958. In this paper, considerations of the theory, design, and usage of low- and high-voltage banks are discussed. Basic electrolytic capacitor properties are reviewed, several particular banks are discussed, and possibilities for future development are examined. Author

N66-27158# California Univ., Livermore. Lawrence Radiation Lab.

TESTS OF OIL-PAPER ENERGY STORAGE CAPACITORS AT HIGH VOLTAGE STRESS TO DETERMINE PROBABLE LIFETIMES

H. Bruce Mc Farlane *In its* Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res. [1965] p 68–71 (See N66-27146 15-25) CFSTI: HC $6.00/MF $1.25

We have re-evaluated a capacitor type that was rated a few years ago at 14 μF, 20 kV. (Several manufacturers have made improvements so that it will now hold 40 kV.) We tested samples of six brands by subjecting them to ringing discharge tests at about 70 kc. Our statistical analysis indicates that two brands are superior to the others. Author

N66-27171# California Univ., Livermore. Lawrence Radiation Lab.

SODIUM CRYOGENIC COILS

C. E. Taylor *In its* Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res. [1965] p 152–155 (See N66-27146 15-25) CFSTI: HC $6.00/MF $1.25

Two large sodium magnets have been built and tested to determine the practicality of operating at cryogenic temperatures, where electrical resistance drops sharply and power requirements are correspondingly reduced. In 1962 an experimental 10-in coil was built and operated at about 21 kG. More recently a 6-in. coil has been built with a more practical construction technique using two-layer, spiral-wound pancake modules. Typical operating levels for the 6-in. coil are 330 W and 4300 A for a 22-kG field 7–10°K, and it has been operated as high as 45 kG. Its construction and operation are described here. Author

N66-27174# Oak Ridge National Lab., Tenn.

OPERATING AND REPAIR EXPERIENCE ON DCX-2 COILS

S. M. De Camp *In* Calif. Univ. Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res. [1965] p 173–176 (See N66-27146 15-25) CFSTI: HC $6.00/MF $1.25

The DCX-2 coils are dc coils designed for 37 kG in the mirror throat and 12 kG in the inboard center for operation with hydrogen injection, and for $\sqrt{2}$ times these fields with deuterium injection. The mirror throat is about 16 in. in diameter, and the inboard i.d. is 42 in. Distance between mirror centers is 160 in. Maximum magnetic force between mirrors for the case of deuterium injection is 116 tons. These coils have a very large space factor and are wound multiple-in-hand with hollow, water-cooled copper for the mirror coils. The coils are insulated with Mylar tape and paper separators between pies and pancakes. During operation of the machine several shorts in the coils were found, either by operation of the ground detector or by magnetic scars. Of the known troubles, all but three could be repaired on the machine. In December 1964, the east mirror coil was removed from service and replaced with a spare coil. The coil that was removed is now under repair. Experience indicates that this type of coil can be readily repaired and individual pancakes replaced where necessary. Author

N66-27177# California Univ., Livermore. Lawrence Radiation Lab.

ASTRON ELECTRON GUN

Charles A. Hurley *In its* Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res. [1965] p 188–192 (See N66-27146 15-25) CFSTI: HC $6.00/MF $1.25

An electron gun has been built that will supply a 200-A, 720-keV electron beam to the Astron accelerator. The heart of the gun consists of an accelerating column that includes a 10-in. oxide-coated cathode and a 13-in. vacuum tight ceramic tube with 15 copper electrodes that pass through the ceramic wall. Surrounding this are 45 one-mil, tape-wound, ferromagnetic cores within which a changing flux generates an electric field along the axis of symmetry of the accelerating electrodes inside the ceramic tube. Surrounding the core package is a pressure vessel containing Freon-12 gas at 30 psig. The Freon-12, used as a dielectric, is circulated in a closed system to cool the cores and accelerating column. Several of the mechanically oriented problems encountered in the design of this apparatus are the fabrication of the ceramic-to-metal accelerating column, the cathode and grid design, the cooling system, and the method of electrically insulating 16 kV in tightly packaged components. Author

N66-27311*# Sperry Gyroscope Co., Great Neck, N. Y.

INTEGRATED SPACECRAFT DISPLAY DEVELOPMENT Final Report

Washington, NASA, May 1966 251 p refs

(Contract NAS4-385)

(NASA-CR-473) CFSTI: HC $6.00/MF $1.50 CSCL 06B

A study was made of the application of projected display techniques to manned space flight. A design specification was generated for a projection display system suitable for use in a fixed base spacecraft simulator. A preliminary design investigation of the use of projection display techniques in spacecraft was conducted which included consideration of such factors as information content, projection display/panel integration, and display/control compatibility. Trade-off studies of various electronic and optical systems were included. The use of the display system was considered for attitude and translational control for rendezvous and lunar landing. Information was generated to permit the establishment of a complete analog simulator evaluation program for this display technique. Author

N66-27620# Union Carbide Nuclear Co., Oak Ridge, Tenn. Y-12 Plant.

HIGH-VOLUME, AIR-MONITOR CALIBRATION FACILITY

Merwyn Sanders and P. C. Mc Ree 9 Feb. 1966 9 p refs

(Contract W-7405-ENG-26)

(Y-1503) CFSTI: HC $1.00/MF $0.50

A high-volume, air-monitor calibration facility was designed and built to accurately calibrate, simply and at a nominal cost, high-volume air samplers. The facility is described. Author (NSA)

N66-27612# Naval Ordnance Lab., White Oak, Md. Explosion Dynamics Div.

EXPLOSIVE OPENING OF A METAL DIAPHRAGM

E. Eugene Kilmer 10 Mar. 1966 16 p refs
(NOLTR-65-204; AD-631327) CFSTI: HC $1.00/MF $0.50

The feasibility of using explosively opened aluminum and steel diaphragms to release the cold driver gas in the shock interaction range was investigated. Diaphragms opened by extruded explosives were found feasible and a reliable system was developed for this application. Author (TAB)

N66-27662# Ohio State Univ. Research Foundation, Columbus.

AN EXPERIMENTAL INVESTIGATION OF THE USE OF NITROUS OXIDE IN HYPERSONIC WIND TUNNEL TESTING FACILITIES Technical Report No. 5

J. R. Nicholson, E. S. Fishburne, and R. Edse Wright-Patterson AFB, Ohio. ARL, Jan. 1966 28 p refs
(Contract AF 33(657)-8951)
(ARL-66-0011; AD-631468) CFSTI: HC $2.00/MF $0.50

Various continuous flow hypersonic wind-tunnel testing facilities are discussed in general and the possibility of employing the exothermic decomposition of nitrous oxide to generate high temperature air is considered in detail. The feasibility of establishing high enthalpy air streams by mixing preheated nitrous oxide with a hot stream of nitrogen which was heated separately to temperatures ranging from 1033°K to 1264°K was investigated experimentally. The temperatures of the pre-heated nitrous oxide ranged from 875°K to 1055°K. After the decomposition of the nitrous oxide the gas mixture attained temperatures between 859°K and 1807°K. When the decomposition process was incomplete the reacted gas contained a substantial quantity of nitrogen dioxide and nitrogen tetroxide. On the other hand only about 1% of these products was formed when the reaction went to completion. The highest temperature of the reacted products amounted to 1807°K which indicates that nearly 80% of the theoretical temperature rise was obtained. Author (TAB)

N66-27845# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

RAMJET TECHNOLOGY. CHAPTER 13: FACILITIES AND TESTING

H. F. Kirk May 1965 42 p refs
(Contract NOw-62-0804-c)
(TG-610-13; AD-630828) CFSTI: HC $2.00/MF $0.50

This report describes several types of ground test facilities used in ramjet research. These include wind tunnels, the free jet facility, and connected pipe testing. The principal components of the free jet facility are described and include the air supply, air heating, free jet nozzles, exhaust, and facility control systems. Structural test facilities, hypersonic testing techniques, and flight testing are also discussed. The major characteristics of several test facilities are tabulated. This table also reflects an up to date summary of those organizations actively working with advanced propulsion systems. This study shows that the testing of a ramjet requires a complex facility and that no one facility is capable of handling a complete test program. Research facilities can provide higher Mach numbers but are limited to small sizes whereas the full-scale facilities are limited in Mach number. R.N.A.

N66-27982*# AVCO Corp., Tulsa, Okla.

EVALUATION OF THERMAL CONTROL COATINGS IN THE SPACE ENVIRONMENT Interim Report

James A. Cooley 1 Nov. 1965 18 p refs
(Contract NASw-1162)
(NASA-CR-75505; TR-65-359-6(a)) CFSTI: HC $1.00/MF $0.50 CSCL 20G

A space environment simulation facility and equipment used for the facility space program are described, and the methods used in the calibration and monitoring of the various parameters are discussed. Space environment simulator test equipment described are: (1) a Van de Graaff accelerator, (2) ultrahigh vacuum chambers, (3) the transition section and beam scanner, (4) the solar simulator, (5) the vacuum ultraviolet source, and (6) the sample holder. The reflectance measuring apparatus, and the temperature control unit are also described. Schematic diagrams of the simulator and the ultrahigh vacuum system are given, along with a photograph of the sample holder. L.S.

N66-27976# Joint Publications Research Service, Washington, D. C.

PLANNING AND CONSTRUCTION OF HELICOPTER STATIONS

L. I. Goretskiy and A. I. Borodach 6 Jun. 1966 292 p refs Transl. into ENGLISH of the book "Proyektirovaniye i Stroitel'stvo Vertoletnykh Stantskiy" Moscow, Stroizdat, 1964 p 1-263
(JPRS-35863; TT-66-32297) CFSTI: $6.00

Technical requirements, takeoff and landing areas, and other aspects in the planning and construction of heliports are considered in detail in this guidebook. Attention is given to ground servicing of helicopters which are used for passenger, postal, and freight purposes. Among the aspects of heliports considered are flight strip dimensions; air approaches; taxi strips, parking areas, and passenger elements; and artificial coverings for helicopter areas and heliports. Marking of transport heliports and obstacle protection are discussed, as are structures and lighting equipment. Also considered are helicopter areas on ship decks, on special foundations over water, and on insular gas collection points. M.W.R.

N66-27993# European Organization for Nuclear Research, Geneva (Switzerland). Accelerator Research Div.

ISOTROPIC SPARK CHAMBER DEVELOPMENT IN THE AR DIVISION: SOME PRACTICAL RESULTS

E. Gygi and F. Schneider 14 Apr. 1966 15 p refs
(CERN-66-14)

A description is given of an isotropic spark chamber which may be operated in two modes. In the first mode, the amplification of electrons is kept small and the electrons of the same track will produce avalanches that radiate approximately the same amount of light. In the second mode, the amplification is greater by at least one order of magnitude. When using this mode the light output is sufficiently large so that a track can be registered directly on a photographic film. Advantages and disadvantages of each mode are given; the photographic apparatus used to record the electron stream is described; and block diagrams of the spark chamber circuitry are included. H.S.W.

N66-28026*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

SPACE PROGRAMS SUMMARY NO. 37-38, VOLUME IV FOR THE PERIOD FEBRUARY 1, 1966 TO MARCH 31, 1966. SUPPORTING RESEARCH AND ADVANCED DEVELOPMENT

30 Apr. 1966 300 p refs
(Contract NAS7-100)
(NASA-CR-75664; JPL-SPS-37-38, Vol. IV) CFSTI: HC $6.00/MF $1.50 CSCL 22A

Progress and status summaries are presented for supporting research and advanced development. Areas of work

include: (1) systems analysis and scientific programming; (2) spacecraft power, guidance, and control; (3) engineering materials and applied mechanics; (4) aerodynamic facilities and environmental and dynamic testing; (5) solid and liquid propellants and propulsion, and polymers; (6) space instruments systems, space biological and physical sciences, and lunar and planetary sciences; and (7) spacecraft radio communications systems, and telemetry and command systems.

D.T.

N66-28032*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

COMPONENT MAGNETIC TEST FACILITY OPERATION AND TEST PROCEDURE MANUAL

C. L. Parsons and C. A. Harris Jul. 1965 104 p

(NASA-TM-X-55495; X-325-65-312) CFSTI: HC $4.00/MF $0.75 CSCL 14B

The physical features and operational functions of the Component Magnetic Test Facility at Goddard Space Flight Center are described and explained in detail. The test procedures have been prepared in particular for performing specific component magnetic field measurements on the OGO and IMP-I (Explorer XVIII) in order to obtain design control data pertinent to these two programs. However, the unique capabilities offered by this laboratory have also been used by several other programs.

Author

N66-28093# Witwatersrand Univ., Johannesburg (South Africa). Dept. of Mechanical Engineering.

INTERNATIONAL SURVEY OF ENGINEERING DESIGN EDUCATION

M. C. De Malherbe and B. W. Firth Jan. 1966 120 p refs (Rept.-33) CFSTI: HC $4.00/MF $0.75

Engineering activities consist of research, design, production, and management. On this basis it appears that some universities are concentrating too much on research and neglecting other equally important aspects of engineering education. Deficiencies of the present system are critically reviewed and some means for reconstruction are suggested. Suggestions are based on recognition of design activities as a fundamental part of engineering studies. A closer tie with industry is advocated to allow for exchange of ideas and the bringing of some of the university staff within the orbit of industrial activities. Thorough study in methods of engineering design tuition is suggested. Mechanical engineering has been the sole field of design activity considered. There is, of course, no suggestion that such an arbitrary restriction should be recognized either in the development or the implementation of methods for the teaching of design.

Author

N66-28115# Federal Aviation Agency, Atlantic City, N. J. Test and Evaluation Div.

EVALUATION OF MINIMUM APPROACH LIGHT SYSTEM FOR LOWER ACTIVITY AIRPORTS Interim Report

Thomas H. Paprocki and Robert F. Gates Feb. 1966 58 p refs

(RD-66-11)

Flight tests were conducted during actual Category I weather conditions at the National Aviation Facilities Experimental Center (NAFEC), Atlantic City, New Jersey, to determine the suitability of three approach light patterns in providing guidance for aircraft approach speeds of 125 knots using ILS into lower activity airports. Each pattern tested provided less visual guidance (fewer lights) than the U.S. Standard Approach Light System. A fourth pattern which was not available during the weather period will be evaluated and test results reported at a later date. It was concluded that the minimum pattern provided adequate visual guidance in a Category I visibility condition with a high approach success rate provided a minimum decision height of 150 feet is authorized with reported ceilings of 200 feet and higher. Several amendments to operating practices were suggested to permit flight to a minimum decision height below a reported ceiling height. It was also concluded that runway visual range alone provided a poor indication of what approach light contact height to expect and, consequently, there was a requirement to provide slant visibility measurements to improve the approach success rate.

Author

N66-28375*# Bell Aerosystems Co., Buffalo, N. Y.

GEOS Final Design Report

Clyde M. Waitby [1966] 44 p *Its* Rept.-60009-517 (Contract NAS9-2988)

(NASA-CR-65377) CFSTI: HC $2.00/MF $0.50 CSCL 14B

Details are given on the prototype design for adding an earth scene to the Agena target image generator, and the insetting of an electronically generated target into this scene. Design features required a provision for color features through a flying spot scanner; high frequency 21" magnetically deflected displays that could be registered adequately to provide a color scene; and a variable frequency, variable amplitude scan generator for producing three components of a scanned spot's position in three-dimension spaces defined in a rectangular coordinate system. Various concepts are examined and assessed, and schematics showing the proposed systems are included. The results indicate that the GEOS system is a feasible technique for earth orbital scene generation, although major problem areas exist. These include the electrical and magnetic noise interference with the display quality, and the resolution reduction in image quality. Recommendations for improvement are proposed.

M.G.J.

N66-28381*# Honeywell, Inc., Minneapolis, Minn. Systems and Research Div.

TRACE MATERIAL GENERATION RATE SIMULATOR (TRACE GAS SIMULATOR) Final Report

E. T. Tromborg 5 May 1966 140 p refs *Its* Rept.-12503-FR1 (Contract NAS9-3998)

(NASA-CR-65383) CFSTI: HC $4.00/MF $1.00 CSCL 14B

A trace material generation simulator was developed to study the effects of contamination on spacecraft crew members and equipment. It is expected that such contamination can occur in normal spacecraft operation from gassing of organic materials used in the construction of equipment, and from human effluent. The prevalent compounds outgassed in oxygen atmospheres by organic engineering materials and the man-generated contaminants are listed, in addition to the ten compounds presently delivered by the trace material control unit. It is stated that a key function of the simulator is the metering system. A separate metering system is provided for each of the ten delivery channels and metering is accomplished in a digital fashion in which trace material delivery takes places as a series of minute flow pulses. The control unit is capable of introducing controlled and programmable amounts of trace contaminants to a closed atmosphere system. This unit may also be programmed to simulate the presence of equipment in a spacecraft atmosphere upon the availability of kinetic data for the organic material involved.

The results of tests conducted with the simulator are described and recommendations are made for additional applications. H.S.W.

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N66-26960# Michican Univ., Ann Arbor. Lab. for Fluid Flow and Heat Transport Phenomena.

ULTRASONIC-INDUCED CAVITATION STUDIES IN MERCURY AND WATER

R. Garcia, R. E. Nystrom, and F. G. Hammitt Dec. 1966 130 p refs

(Grant NSF G-22529)

(TR-3)

Damage to various materials, including refractory alloys, steels, brasses, coppers, etc. from ultrasonically induced cavitation in mercury at 70° and 500°F and in water at 70°F was investigated. In addition, comprehensive computer correlations of the cavitation damage data with applicable mechanical and fluid properties were obtained. The results indicate: (1) No single material mechanical property can be used successfully to correlate the damage data. (2) The best correlations include one or more energy-type mechanical properties, one or more strength properties, and one or more fluid coupling parameters. (3) No relatively simple single correlating equation applied well to all the data. This last suggests the insufficiency of the statically determined fluid and mechanical properties for the correlation of cavitation damage, which is known to be a highly transient process. It is finally noted that damage achieved in the mercury at 70°F ranged from three to twenty times the damage achieved in water at the same temperature. D.T.

N66-27000# Library of Congress, Washington, D. C. Aerospace Technology Div.

A PARAMETRIC METHOD OF INTEGRATING LAMINAR-BOUNDARY LAYER EQUATIONS [PARAMETRICHESKIY METOD INTEGRIROVANIYA URAVNENIY LAMINARNOGO POGRANICHNOGO SLOYA] Surveys of Soviet-Bloc Scientific and Technical Literature

Victor Klein 28 Mar. 1966 21 p refs Transl. into ENGLISH from Tr. Leningr. Politekhn. Inst. (USSR), no. 248, 1965 p 45–55

(ATD-66-30)

A method is presented for integrating laminary boundary layer equations which permits a transform into a universal form by replacing the longitudinal coordinate with a system of successive "formparameters" to determine the effect of velocity distribution at the outer surface of the boundary layer. A preliminary numerical integration is assumed, which is followed by the tabulation of the reduced stream function, a reduced coefficient of friction at the wall, and other parameters characteristic of the boundary layer. Calculations are made by the use of tables rather than by electronic computers; and a practical example is included in the analysis of a sine-law distribution of the outer velocity. While the example is a simple one, it does point out the rapid convergence of the new method and the special role of the point of separation. M.W.R.

N66-27063*# Douglas Aircraft Co., Inc., Santa Monica, Calif.

SPECTRA AND SPACE-TIME CORRELATIONS OF THE FLUCTUATING PRESSURES AT A WALL BENEATH A SUPERSONIC TURBULENT BOUNDARY LAYER PERTURBED BY STEPS AND SHOCK WAVES

W. V. Speaker and C. M. Ailman Washington, NASA, May 1966 150 p refs

(Contract NASw-932)

(NASA-CR-486) CFSTI: HC $5.00/MF $1.00 CSCL 01A

Pressure fluctuations induced at a wall by a turbulent boundary layer were obtained in uniform flow at subsonic speeds and in both uniform and perturbed flow at supersonic speeds. The flow perturbations resulted from use of forward- and aft-facing steps and shock waves. The data are presented in terms of spatial distribution of overall levels, energy distribution in the frequency domain, and broad-band correlation in space and time. Included in the analysis are discussions on the following: (1) Mach number dependence of the overall levels in uniform flow; (2) methods of nondimensionalizing the power spectra to compress the data; (3) comparison of results from several experimenters; (4) typical power spectra for specific regions of perturbed flow; (5) convection velocities in uniform and perturbed flows; (6) space-time correlations of the fluctuating pressures; (7) feasibility of separating the cross-correlation function into a product of functions dependent on only one variable; and (8) mathematical descriptions of the cross-correlation functions. Author

N66-27075*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

DISPLACEMENT THICKNESS OF THE BOUNDARY LAYER WITH BLOWING

Nisiki Hayasi [1965] 7 p refs Submitted for Publication

(NASA-TM-X-56737) CFSTI: HC $1.00/MF $0.50 CSCL 20D

This paper considers the displacement thickness for the two-dimensional or axisymmetric compressible boundary layer with either large or small amounts of blowing for bodies of arbitrary shape. It is assumed that no chemical reaction occurs in the boundary layer. It is shown that the conventional displacement thickness is grossly in error for cases where a large amount of injection takes place at the wall. Such a large amount of injection is common for the ablation problem, where the order of the injection parameter is between 10 and 100. R.N.A.

N66-27076*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

WAVE-PLAN ANALYSIS OF UNSTEADY FLOW

Don J. Wood, Robert G. Dorsch, and Charlene Lightner 12 Jul. 1965 42 p refs Submitted for Publication

(NASA-TM-X-56728) CFSTI: HC $2.00/MF $0.50 CSCL 20D

A digital distributed parameter model for computing unsteady flow in liquid-filled fluid systems is presented. The wave-plan method employed in the model involves essentially the synthesis of incremental pressure pulses. The analysis is presented in a form general enough to be applied to a variety of hydraulic systems. To illustrate the application of the method to a specific system, the response of a long, straight liquid-filled line to sinusoidal inlet flow and pressure perturbations is computed. Both a constant-cross-section line and a tapered line are analyzed in the example. Author

N66-27079*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EXPLORATORY MEASUREMENTS IN SPIRAL TURBULENCE
Charles Van Atta [1965] 38 p refs Submitted for Publication
(Contract NAS7-100)
(NASA-CR-64421) CFSTI: HC $2.00/MF $0.50 CSCL 20D

The present experiments lay a foundation for a study of interface propagation in a mixed laminar–turbulent flow between counter-rotating concentric cylinders. Such mixed flows are found to be a dominant feature of transition in Couette flow. In spiral turbulence, the laminar and turbulent regions of the flow form an alternating pattern of helical stripes, rotating with approximately the mean angular velocity of the two cylinders. Stable right- and left-handed spirals occur with equal probability when the flow is established from rest. Hot-wire measurements have been made of the mean cross-sectional shape of the interfaces in the axial mid-plane for a spiral-turbulent flow having low dispersion in interface position. A nose of turbulence associated with the leading interface projects into a laminar region near the outer cylinder, while a corresponding tail is associated with the trailing interface near the inner cylinder. Fluctuations in interface position and in apparent length of the turbulent region are closely Gaussian, and the fluctuations are rapid compared with the period of rotation of either cylinder. Author

N66-27185*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL EVALUATION OF PRESSURANT GAS INJECTORS DURING THE PRESSURIZED DISCHARGE OF LIQUID HYDROGEN
Richard L. De Witt, Robert J. Stochl, and William R. Johnson Washington, NASA, Jun. 1966 39 p refs
(NASA-TN-D-3458) CFSTI: HC $2.00/MF $0.50 CSCL 20D

The effect of pressurant gas injector geometry on the pressurant gas (hydrogen) required during discharge of liquid hydrogen from a 29-cubic-foot cylindrical tank was determined. Tests were conducted for a range of expulsion times at a nominal operating pressure level of 160 pounds per square inch absolute and with inlet pressurant gas temperatures between 508° and 558°R. Data were obtained using six injector geometries (cone, hemisphere, disk, radial, multiple screen, and straight pipe). The first five injectors, which gave some degree of distribution or diffusion of pressurant gas into the top of the tank, were found to have similar pressurant gas requirements (within 10 percent) during the expulsion period. The straight pipe injector, which introduced the pressurant gas in a concentrated stream towards the liquid surface, showed a significant decrease in pressurant gas required for comparable propellant outflow rates. The experimental results for the multiple screen, cone, and 1-inch-diameter straight pipe injectors were compared with results predicted by a previously developed analytical method. This comparison indicated that good agreement existed between the analysis and experimental data for the diffuser-type injectors. It was experimentally determined that the use of a floating insulation layer at the liquid–gas interface had little effect on overall gas requirements for expulsion. Author

N66-27190*# Consultants and Designers, Inc., Arlington, Va.
METHOD OF COMPUTING THREE DIMENSIONAL FLOWS PAST BODIES AFTER SHOCKWAVE PASSAGE [METOD RASCHETA PROSTRANSTVENNOGO OBTEKANIYA TEL S OTOSHEDSHEY UDARNOY VOLNOY]
G. F. Telenin and G. P. Tinyakov 10 Apr. 1964 5 p Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Gidromekhan. (Moscow), v. 154, no. 5, 11 Feb. 1964 p 1056–1058
(Contract NAS5-2078)
(NASA-TT-F-8682; ST-AD-10125) CFSTI: HC $1.00/MF $0.50 CSCL 01A

A numerical method for integrating gas dynamic equations was generalized to apply to the case of three-dimensional flow past solid bodies after passage of a shock wave. Results obtained by using this method are given for the case of an orbiting ellipsoid. R.T.K.

N66-27207*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STRUCTURE AND UTILIZATION OF SUPERSONIC FREE JETS IN LOW DENSITY WIND TUNNELS
Harry Ashkenas and Frederick S. Sherman (Calif. Univ., Berkeley) [1964] 28 p refs Prepared in cooperation with Calif. Univ., Berkeley
(Contracts NAS7-100; Nonr-222(45))
(NASA-CR-60423) CFSTI: HC $2.00/MF $0.50 CSCL 01A

Results of inviscid flow theory, shock wave configurations in nearly inviscid flow, viscous effects in free jets, application of free jets as wind tunnel streams, and techniques of experimental evaluation in viscous and more rarefied regimes are reviewed. Flow properties, dissipation effects, boundary layer effects, shock wave and mixing layer thickening, and stagnation heating are discussed. Impact pressure measurements, and molecular and electron beam methods are mentioned. It was concluded that free jets can be seriously considered as an alternative type of low density wind tunnel stream. Impressive extensions of the Mach and Reynolds number ranges, while maintaining nearly inviscid flow conditions, are reported. The inviscid theory is felt to be satisfactory and the slightly viscous flow theory appears reasonable. N.E.N.

N66-27248# Los Alamos Scientific Lab., N. Mex.
THE MAC METHOD: A COMPUTING TECHNIQUE FOR SOLVING VISCOUS, INCOMPRESSIBLE, TRANSIENT FLUID-FLOW PROBLEMS INVOLVING FREE SURFACES
J. Eddie Welch, Francis H. Harlow, John P. Shannon, and Bart J. Daly 21 Mar. 1966 144 p refs
(Contract W-7405-ENG-36)
(LA-3425) CFSTI: $4.00

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1. DESCRIPTION OF THE METHOD Francis H. Harlow p 7–42
2. THE COMPUTER PROGRAM J. Eddie Welch p 43–97
3. SOME CALCULATIONAL EXAMPLES John P. Shannon, J. Eddie Welch, and Francis H. Harlow p 98–119
4. TWO-MATERIAL CALCULATIONS Bart J. Daly p 120–146 refs

N66-27361# Oak Ridge National Lab., Tenn.
REPORT OF AN INFORMAL STRIATION MEETING HELD AT THE SEVENTH INTERNATIONAL CONFERENCE ON PHENOMENA IN IONIZED GASES, BELGRADE, YUGOSLAVIA, AUGUST 22-27, 1965
I. Alexeff and W. D. Jones 25 Oct. 1965 7 p ref
(Contract W-7405-ENG-26)
(ORNL-TM-1307) CFSTI: HC $1.00/MF $0.50

A list of delegates who attended the session, as well as a brief summary of discussions given by various delegates concerning their work on striations, is included. Author (NSA)

N66-27429# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

STUDY OF THE TRANSITION OF A TURBULENT BOUNDARY LAYER INTO A LAMINAR ONE

M. E. Deich and L. Ya. Lazarev 18 Mar. 1966 13 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (Minsk), v. 7, no. 4, 1964 p 18–24 *Its* Library Bull. Transl. Ser.

(Contract NOw-62-0604-c)

(TG-230-T470; TT-66-60966; AD-630888) CFSTI: HC $1.60/MF $0.50

The results of an experimental study of the transition of a turbulent boundary layer into a laminar one at transonic velocities in various tunnels are presented. An approximate estimate is given of the effect of various factors on the nature of the turbulent–laminar transition in the boundary layer, as well as the conditions governing the initiation of such reverse transition. Author (TAB)

N66-27498*# National Aeronautics and Space Administration, Washington, D. C.

PROBLEMS OF OSCILLATIONS OF A FLUID SUBJECTED TO SURFACE TENSION FORCES [ZADACHI KOLEBANIY ZHIDKOSTI, PODVERZHENNOY SILAM POVERKHNOSTNOGO NATYAZHENIYA]

N. N. Moiseyev and F. L. Chernous'ko May 1966 45 p refs Transl. into ENGLISH from Zh. Vychislitel'noi Mat. i Mat. Fiz. (Moscow), v. 5, no. 6, 1965 p 1071–1095

(NASA-TT-F-10141) CFSTI: HC $2.00/MF $0.50 CSCL 20D

Various problems associated with fluid behavior under conditions of weightlessness and in weak gravitational fields are examined, and possible solutions are proposed. The problem of small linear oscillations of an ideal fluid in the presence of surface tension is formulated, and the properties of the spectra are established. It is shown that an effective solution can be obtained when the surface tension is small in comparison with mass forces. Several conclusions based on the known theorems of the spectral theory of linear operations are presented. Problems of oscillation theory are also assessed, with attention focussed on the elementary case of a weightless fluid in an axisymmetric vessel. Narrow band asymptotic methods are used, and only axisymmetric oscillation modes are considered. Equations are also formulated for the equilibrium and natural oscillations of a heavy ideal fluid in a vessel, and for natural oscillations in the presence of small surface tension. Several examples are included. M.G.J.

N66-27528*# Advanced Technology Labs., Mountain View, Calif.

RESEARCH ON DIFFUSION OF HYDROGEN THROUGH PALLADIUM–SILVER ALLOY, PHASE 3 Final Report, Apr. 1964–May 1965

R. C. Bachmann 31 May 1965 108 p refs

(Contract NAS7-118)

(NASA-CR-75435; ATL-D-1306) CFSTI: HC $4.00/MF $0.75 CSCL 20D

This study was conducted on hydrogen gas diffusion through palladium–silver alloy with emphasis on generating information on the characteristics of the hydrogen diffusion valve principle when electric current is applied. Diffusion elements were fabricated from various lengths of palladium–silver alloy tubing. Diffusion was measured by causing the diffused hydrogen to flow into a vacuum chamber for a given time interval. Hydrogen flow rate measurements were generated as functions of the mean diffusion element temperature, the dc power required to maintain the temperature, and the hydrogen pressure differential across the diffusion element. An empirical equation was determined from the data to predict the hydrogen diffusion unit flow rates for specific test conditions. With a view to using the hydrogen diffusion principle in a low thrust satellite attitude control system, attainable thrust levels for different operating conditions were estimated and possible power input optimization methods were studied. Results show that a thruster with a 40-in diffusion element at 350° F can produce a 100 micropound thrust using 3 watts of power. R.N.A.

N66-27584# Aix-Marseilles Univ. (France). Institut de Mecanique Statistique de la Turbulence.

MACROSCOPIC EULERIAN DERIVATIVE OF A VOLUME INTEGRAL ENTROPY OF A TURBULENT GAS. SOME SPECTRAL MEASUREMENTS OF SPACE–TIME CORRELATIONS Annual Summary Report No. II

A. J. Favre, R. Dumas, and E. Verollet Jan. 1966 44 p refs

(Contract AF 61(052)-772)

(AFOSR-66-0614; AD-630629) CFSTI: HC $4.60/MF $0.50

This paper presents expressions concerning the derivative of the integral of a characteristic of a fluid in a volume following the macroscopic movement, with application to entropy, and gives a statistical equation of entropy for a turbulent compressible gas. New measurements are made of space–time correlations spectra for velocities in a turbulent boundary layer. The maximum maximorum correlation is decreasing when the frequency is increasing, but its location is not much affected by the frequency. Author

N66-27585# Picatinny Arsenal, Dover, N. J. Feltman Research Labs.

PROPAGATION OF A STRONG DISCONTINUITY IN AN INHOMOGENEOUS ATMOSPHERE

E. I. Andriankin, A. M. Kogan, A. S. Kompaneyets, and V. P. Kraynov Apr. 1966 16 p refs Transl. into ENGLISH from Zh. Prik. Mekhan. i Techn. Fiz. (Moscow), no. 6, Nov.–Dec. 1962 p 3–7

(PA-TT-6; AD-630769) CFSTI: HC $1.60/MF $0.50

In this paper is presented a hydrodynamic calculation of a strong discontinuity in an inhomogeneous atmosphere. It is found that after a finite time the shock front diverges toward infinity. It is shown that, no matter how severe the discontinuity may be, no strong shock wave may be propagated below a distance greater than 16.5 km. The velocity and pressure in the propagating shock wave are determined as functions of time. Conversion formulas are given for various energies and heights of the discontinuity. The regions of validity of the formulas are indicated. Author (TAB)

N66-27599# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

FORMATION OF THE FLOW UPSTREAM OF A SHOCK WAVE EXPELLED FROM A NOZZLE

A. I. Starshinov 14 Mar. 1966 6 p refs Transl. into ENGLISH from Vestn. Leningr. Univ., no. 13, Ser. Mat., Mekh. i Astron. (Leningrad), no. 3, 1965 p 125–127

(Contract NOw-62-0604-c)

(TG-230-T469; AD-630867) CFSTI: HC $1.10/MF $0.50

Theoretical investigations of the formation of the gas flow behind a shock wave expelled from a nozzle are presented. A method of calculation is given. Author (TAB)

N66-27602# David Taylor Model Basin, Washington, D. C. Applied Mathematics Lab.

THE GRAM-CHARLIER APPROXIMATION OF THE NORMAL LAW AND THE STATISTICAL DESCRIPTION OF A HOMOGENEOUS TURBULENT FLOW NEAR STATISTICAL EQUILIBRIUM Final Report

Joseph Kample de Feriet (Lille Univ.) Mar. 1966 29 p refs (DTMB-2013; AD-630745) CFSTI: HC $2.60/MF $0.50

The probability density distribution is discussed for two correlated random variables based on an approximation to a normal (Gaussian) law using Hermite polynomials of two variables. Author (TAB)

N66-27651# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

RAREFACTION EFFECTS ON IMPACT PRESSURE PROBES IN HYPERSONIC FLOW

Fred L. Daum, J. S. Shang, and G. A. Elliott Sep. 1965 35 p refs

(ARL-65-176; AD-631477) CFSTI: HC $3.60/MF $0.50

An experimental investigation of impact pressure behavior was conducted at elevated hypersonic Mach numbers and low Reynolds numbers. The results clearly indicated a Mach number dependence of the impact pressure characteristics. It was demonstrated that at constant Reynolds number, the impact pressure ratio increases systematically with increasing Mach number in the fully merged flow regime. It was found that no single parameter would adequately correlate the data throughout the complete range of test conditions. However, verification of the existence of a hypersonic similarity parameter for the blunt body was demonstrated over the test Reynolds number range of 50 to 350. A qualitative explanation of the observed pressure behavior has been suggested based on an assumed physical model. It appears that the continuum approach to theoretical blunt body flows could be further extended into the rarefied flow regime through proper analytical treatment of the rarefaction effects on the bow shock wave. Author (TAB)

N66-27656# Syracuse Univ. Research Inst., N. Y. Dept. of Mechanical and Aerospace Engineering.

INTERACTION OF A RECTILINEAR CIRCULAR VORTEX FLOW FIELD WITH A PROGRESSING EXPANSION WAVE

Gene K. Baxter and Darshan S. Dosanjh Mar. 1966 61 p refs (Grants DA-ARO(D)-31-124-G210; DA-ARO(D)-31-124(G615; NSF GP-1137)

(ME931-6603-IT; AROD-3242-5; AD-631287) CFSTI: HC $3.00/MF $0.75

A theoretical analysis of the non-steady interaction of a rectilinear circular vortex flow field with a progressing expansion wave is developed. The expansion wave was assumed to remain linear throughout the interaction. The analysis describes the non-steady behavior of a single particle from the potential region of the vortex flow field as it passes through the expansion wave and the analysis is then extended to describe the behavior of any fluid curve selected from the original circular streamlines of the vortex flow field. The solution of the interaction problem was found by using standard numerical analysis procedures and the numerical solution was then programmed and performed on an IBM 7074/1460 digital computer/plotter system. The major effect of the interaction is found to be a linear stretching of the vortex flow field coupled with an asymmetric skewing effect which decreases with increasing radius from the vortex core. The numerical solution was qualitatively evaluated and found to give results which are physically valid for the portion of the vortex flow field in which the magnitude of the radial vortex pressure gradient is smaller than the magnitude of the pressure gradient of the expansion wave during the time of interaction. Author (TAB)

N66-27681# Brown Univ., Providence, R. I. Div. of Engineering.

THE RAYLEIGH PROBLEM IN A RADIATING COMPRESSIBLE GAS. PART I: PLATE MACH NUMBER FINITE

Alexander Solan and Ira M. Cohen Mar. 1966 114 p refs (Nonr-562(35)

(Rept.-10, AD-631734) CFSTI: HC $11.60/MF $0.75

The flow of a compressible, viscous, heat-conducting, radiating gray gas near a flat plate set impulsively in motion in its own plane is considered and solved in certain limiting cases. The problem is formulated for general values of the Boltzmann number Bo (convection-radiation ratio). The plate Mach number is assumed to be sufficiently large so that a significant amount of heat is generated by dissipation but not so large that the orders of magnitude of the thermophysical properties are changed. Asymptotic expansions are made for large ratio of the photon to molecular mean free path, N, taking into account the effect of Bo. In the limit N approaching infinity, with Bo finite and plate temperature equal to the temperature of the gas at rest, the asymptotically optimal scalings split the problem into an optically thin, compressible, viscous boundary layer with radiative emission but no self-absorption and an optically finite, inviscid, acoustic flow with full radiative interaction. The inviscid region beyond the boundary layer may be treated at the acoustic level because the velocity transverse to the plate is small compared with that parallel to the plate, and because the energy transported by radiation is small since the boundary layer is very thin even though it may be emitting quite intensively. The equations in the boundary layer and in the inviscid region are solved numerically for several representative cases. It is found that the velocity profile in the boundary layer is only weakly affected by radiation. Author (TAB)

N66-27683# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

FLOW IN A DELAVAL NOZZLE BY THE GARABEDIAN METHOD

John V. Armitage Jan. 1966 42 p refs

(ARL-66-0012; AD-631401) CFSTI: HC $9.60/MF $0.75

The problem of computing the flow in a deLaval nozzle when an initial velocity is specified along the axis of symmetry is considered. Fortran II programs are presented for computing the flow pattern in the subsonic region, for extrapolating the data to the sonic line, for extrapolating from the sonic line into the supersonic region, and for extending the computation into the supersonic region. Author (TAB)

N66-27761# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.

VORTICAL SINGULARITIES IN CONICAL FLOW

R. E. Melnik May 1966 37 p refs Presented at the AIAA 4th Aerospace Sci. Meeting, Los Angeles, 27-29 Jun. 1966 (RE-251J)

The behavior of inviscid supersonic conical flow fields near crossflow stagnation points is investigated by constructing coordinate expansions of the exact equations of conical flow. The local crossflow streamline pattern is shown to be determined primarily by the curvature of the

surface pressure distribution, p, and by the direction of the surface velocity near the stagnation point. The local streamline pattern at a maximum of the surface pressure is shown to be either a saddle point, or a nodal point with crossflow streamlines normal to the body. The solution corresponding to the node changes to a saddle point at a critical value, $p=p_1$, which thus signals the lift-off of the vortical singularity. The streamline pattern at a minimum of the pressure distribution is a node with streamlines tangent to the body if p is less than a critical value, p_2, and does not exist if $p>p_2$. The local solutions are used to infer the general characteristics of the crossflow streamline pattern generated by yawed circular cones and flat plates. They are also used to analyze the nonuniformity of the small yaw and thin-shock-layer expansions at vortical singularities. Author

N68-27816# Politecnico di Torino (Italy). Istituto di Meccanica Applicata.

EXPERIMENTAL RESEARCH ON THE EFFECT OF PRESSURE GRADIENT AND FREE STREAM TURBULENCE ON THE BOUNDARY LAYER OF A FLAT ROUGH PLATE Scientific Report No. 9

Ennoi Mattioli Nov. 1965 32 p refs Presented at 14th Natl. Congr. of AIDA, Naples, 25-28 Oct. 1965 *Its* Tech. Note 33 (Grant AF-EOAR-63-98)

(AFOSR-66-0339; AD-630799) CFSTI: HC $2.00/MF $0.50

A determination was made of displacement thickness and a momentum loss thickness in the boundary layer of a rough flat plate at low velocities, at various conditions of wall roughness, pressure gradient and free stream turbulence. The opportunity is discussed to assume y=0 at the 'top plane' of the rough surface, taking as additional parameter the flow velocity at the wall. New results are indicated about the slowing down of the stream near the wall, about the turbulence mainly initial effect, about the presence of a boundary layer above the boundary layer, as a consequence of the combined action of pressure gradient and free stream turbulence. Author (TAB)

N68-27835# Picatinny Arsenal, Dover, N. J. Feltman Research Labs.

HIGH VELOCITY CUMULATIVE JETS

N. P. Novikov Apr. 1966 15 p refs Transl. into ENGLISH from Probl. Mat. i Teoretichnoy Fiz. (USSR), v. 6, 1962 p 22-28

(PA-TT-5; AD-630649) CFSTI: HC $1.60/MF $0.50

The report describes the obtaining of high-velocity cumulative jets, studies the structure of jets through photographic frames as well as their content by means of luminous spectra, deduces a number of relationships between the velocity of the high-velocity jets and various parameters, and, finally, attempts to examine the high-velocity and the basic cumulative jet as the outflow of a metal under high pressure into a vacuum. Author (TAB)

N68-27838# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.

TRANSPORT COEFFICIENTS FOR DENSE GASES

J. R. Dorfman [1965] 24 p refs Presented at 4th Eastern Theoret. Phys. Conf., Stony Brook, N. Y., 26-27 Nov. 1965

(Grant AF-AFOSR-1015-66)

(AFOSR-66-0334; AD-630588) CFSTI: HC $2.60/MF $0.50

A convergent theory for the density dependence of transport coefficients for a moderately dense gas is discussed. Since the terms in the original density expansion depend upon the dynamics of successively higher numbers of particles, one can classify the divergences that appear in terms of the associated dynamical events. The most divergent terms are always determined by sequences of binary collisions. The summation of the most divergent terms produces a collision damping which keeps the interval between successive binary collisions to within a few mean free times. The resumed expression for the viscosity due to Kawasaki and Oppenheim was partially evaluated. One can say that terms proportional to $n^{d-1} \log n$, where d is the number of dimensions, appear in the density expansion, however, the precise coefficients of the logarithm have not yet been established. Author (TAB)

N68-27870# Douglas Aircraft Co., Inc., Long Beach, Calif. Aircraft Div.

STUDY OF A GENERAL METHOD OF SOLUTION TO THE INCOMPRESSIBLE TURBULENT BOUNDARY LAYER EQUATIONS

A. M. O. Smith, N. A. Jaffe, and R. C. Lind 11 Nov. 1965 127 p refs

(Contract NOw-64-0352c)

(LB-52949; AD-631329) CFSTI: HC $4.00/MF $1.00

A general method of solution to the mean (time averaged) flow equations governing the turbulent boundary layer is attempted. The problem of incompressible flow is considered as an initial step toward the solution of the more general problem of compressible flow. In the approach adopted, once the Reynold's shear stress is formulated in terms of an eddy viscosity, no further approximations are made. The accuracy of the eddy viscosity can be assessed only by comparison of the calculated results with experimental data. An eddy viscosity formulation believed to incorporate the latest knowledge on turbulent boundary layers has been made. Calculations have been made for a considerable number of flows and comparison with experimental data indicates that the present formulation has produced remarkably accurate solutions. Author (TAB)

N68-27902# Heliodyne Corp., Los Angeles, Calif.

RE-ENTRY PHYSICS RESEARCH Final Technical Summary Report, 12 Jun. 1964-11 Jun. 1965

Ali Hasan Nayfeh et al Jun. 1965 22 p refs

(Contract DA-04-495-AMC-458(Z); ARPA Order 380; Proj. Defender)

(AD-626005) CFSTI: HC $1.00/MF $0.50

Studies were performed in the following areas: (a) two-dimensional and axisymmetric laminar wake stability, (b) mixing and chemical reactions in a nonequilibrium turbulent wake, (c) analyses of the properties of schlieren records of turbulent wakes, (d) analyses of molecular transition probabilities in high temperature gas kinetic collisions, (e) analyses of shock wave structure in a particle-gas dispersion, (f) analyses of the rate of burnup of particles behind a moving normal shock wave, (g) development of a powder injection shock tube facility, (h) experimental measurements of the rate of burnup of teflon particles behind a normal shock wave in argon, (i) absorption spectra in shock heated teflon/argon and teflon/nitrogen mixtures, (j) experimental measurements of the electrical conductivity of air and air plus teflon mixtures, and (k) analyses of optical scintillation data from re-entry vehicle tests. Author (TAB)

N68-27916# Los Alamos Scientific Lab., N. Mex.

REZONE—A PROPOSAL FOR ACCOMPLISHING REZONING IN TWO-DIMENSIONAL LAGRANGIAN HYDRODYNAMICS PROBLEMS

Philip L. Browne 21 Sept. 1965 20 p refs
(Contract W-7405-ENG-36)
(LA-3455-MS) CFSTI: HC $2.00/MF $0.50

A proposed numerical experiment is described, in which an attempt is made to provide a code that will rezone a two-dimensional Lagrangian hydrodynamics problem by allowing mass and the related momenta and internal energy to be transferred from one zone to another as the grid lines are moved through the material. Author (NSA)

N66-28000# Aeronautical Research Council (Gt. Brit.).
THE SUPERSONIC FLOW PAST A CIRCULAR CONE AT INCIDENCE
B. A. Woods London, HMSO, 1965 29 p refs Supersedes RAE-TN-AERO-2939, ARC-25876
(ARC-R&M-3413; RAE-TN-AERO-2939; ARC-25876) CFSTI: HC $2.00/MF $0.50

The problem of calculating the supersonic flow past a circular cone at small incidence α is treated by the method of inner and outer expansions, on the assumption that it can be expressed as a perturbation (in powers of α) of the corresponding axially symmetric flow. Stone's first-order solution, and the first-order vertical-layer solution are connected as the first-order terms in the outer and inner expansions for the flow. It is shown that the logarithmic infinities which occurred in Stone's second-order solution are removed from the final (composite) solution for second-order terms by application of the generalized matching principle, and the second-order terms in the expansions of the inner solution are obtained. Author

N66-28074# Lockheed Missiles and Space Co., Sunnyvale, Calif.
BASE PRESSURE FOR A SUDDEN EXPANSION OF THE SONIC FLOW
O. S. Zelenkov and A. V. Iurkov [1966] 9 p refs Transl. into ENGLISH from Math., Mekh. and Astron. (Leningrad), no. 7, 1966 p 76–80

A method was devised for computing the base pressure taking into account the width of the mixing zone and the thickness of the boundary layer on the nozzle wall. It was assumed that the magnitude of the base pressure equals the static pressure in the interaction section of the jet and nozzle during the expansion of a one-dimensional isotropic jet from the critical nozzle section. D.T.

N66-28078# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.
ON THE DETERMINATION OF THE LINEARIZED FLOW PERTURBATIONS OF A NONAXIALLY SYMMETRIC CONICAL BODY IN HYPERSONIC FLOW [K OPREDELENIYU LINEARIZOVANNYKH POTOKOV VOZMUSHCHEVII PRI GIPERZVUKOVOM OBETKANII NEOSESIMMETRICHNYKH KONICHESKIKH TEL]
A. M. Mkhitoryan and Orayannikov Apr. 1966 20 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Aviats. Tekh. (Kazan), no. 1, 1965
(TR-32)

Hypersonic flow over thick nonaxially symmetric conical bodies was investigated, based on extension of two earlier studies. These consisted of: (1) a numerical method of superimposing linearized solution on the nonlinear solution for a circular cone for solving the problem of supersonic flow of an inviscid, non-heat conducting gas over nonaxial symmetric conical bodies, and (2) determining velocity components of linearized flow perturbations for hypersonic flow over slender nonaxially symmetric conical bodies. The basic differential equations, boundary conditions, and simplifying assumptions are given. The velocity components of the perturbed flow are determined. It was concluded that an analytical determination of the aerodynamic characteristics is possible, and that the solution is considerably simplified in comparison with the earlier numerical method. The case defines the asymptotic behavior of the linearized flow perturbations for hypersonic velocities as the shock angle increases to the limit. It was further concluded that for large shock angles, satisfactory agreement is obtained in comparison with the numerical solution. N.E.N.

N66-28123# Lockheed Missiles and Space Co., Sunnyvale, Calif.
INFLUENCE OF THE INITIAL BOUNDARY LAYER ON BASE PRESSURE
R. K. Tagirov [1966] 10 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Mekhan. Zhidk. i Gaza (Moscow), no. 2, 1966 p 145–148

The base pressure p_b in the supersonic, non-isothermal flow around a flat ledge is determined taking into account the initial turbulent boundary layer. A similar problem was examined earlier. The Korst condition, assuming the total pressure p_j^* on lines of constant mass to be equal to the pressure behind a closed oblique compression shock, was used in the solution. However, the pressure in the adhesion section p_* is 30–40% lower than the pressure behind a closed shock, and therefore, the Korst condition is not accurate enough. Hence, only qualitative agreement with experiment was attained in the mentioned works. In another work, p_* is introduced, however, it is determined by using an empirical coefficient. The condition of mass conservation in the base region, described by the equality $p_j^*=p_*$, where p_* is determined from the assumption of minimum thickness of the dissipative layer in the adhesion section, is used herein to find p_b. Satisfactory agreement with existing experimental results is achieved without correcting coefficients. In the simplest case, when the initial boundary layer thickness is $\delta_1=0$, the expounded method is no more complicated than the Korst method. The determination of the base pressure for $\delta_1=0$ is considered in section 1, and for $\delta_1>0$ in section 2. Author

N66-28124# Lockheed Missiles and Space Co., Sunnyvale, Calif.
LAMINAR BOUNDARY LAYER ON A SPHERE IN THE HYPERSONIC FLOW OF EQUILIBRIUM DISSOCIATING AIR
I. N. Murzinov [1966] 11 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Mekhan. Zhidk. i Gaza (Moscow), no. 2, 1966 p 184–188

Briefly expounded herein is a method and results of numerical computations are presented of the laminar boundary layer on a sphere moving at hypersonic velocity. It is assumed that the air in the boundary layer is in equilibrium dissociation, but the Prandtl number is taken constant in the majority of the computations. As individual computations have shown, the assumption of constant Prandtl number is not reflected in practice on the distribution of the heat fluxes at the sphere. The heat flux distribution on the sphere for $M_\infty \gtrsim 10$ and $I_w << I_0$ is general in nature. This permitted the results of the analyses to be approximated by a simple formula. Author

N66-28133# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Berlin (West Germany).
INVESTIGATIONS ON THE DEFLECTION OF FREE JETS BY WALLS OF CONVEX CURVATURE (COANDO EFFECT) [ZUR UMLENKUNG VON FREISTRAHLEN AN KONVEX GEKRUEMMTEN WAENDEN (COANDA-EFFEKT)]
Hans-Herman Fernholz Apr. 1966 111 p refs In GERMAN; ENGLISH summary
(DLR-FB-66-21; DVL-487) CFSTI: HC $4.00/MF $0.75

Previous investigations on viscous wall jets were reviewed. An approximate integral method for calculating the separation region of the wall jet was established. Laws were formulated for the behavior of curved wall jets; and on the basis of these laws, the relative importance of the various flow parameters was determined. Experiments were performed dealing with strong three-dimensional disturbances caused by the presence of side walls. D.T.

N66-28171# United Kingdom Atomic Energy Authority, Risley (England). Library and Information Dept.
BIBLIOGRAPHY ON CAVITATION IN FLUIDS, JANUARY 1963–31 OCTOBER 1965
U. R. M. Chadwick 1966 28 p
(TRG-518(R)) HMSO: 3s 6d

Books and pamphlets, reports, and journal articles are listed in a bibliography on cavitation in fluids. The book and pamphlet listing is alphabetically by author; reports are listed by serial reference and/or source; and the journal articles are presented in chronological order, with the latest studies first. M.W.R.

N66-28173# United Kingdom Atomic Energy Authority, Culham (England).
A MONTE CARLO COMPUTER PROGRAMME FOR ANALYSIS OF MOLECULAR GAS FLOW
J. N. Chubb Dec. 1965 51 p refs
(CLM-R-54) HMSO: 6s

Molecular gas flows cannot be studied analytically within vacuum systems in which a pumping orifice or surface forms an appreciable fraction of the total internal surface area of the system. Such systems may be studied successfully by the Monte Carlo method in which an average picture of the molecular flow is by mathematical simulation of the course of a large number of individual molecular histories within a mathematical representation of the vacuum system. A description is given of a Monte Carlo computer program which has been developed for analysis of molecular gas flow, with emphasis placed on the ease of use and on the practical application of the information which may be extracted. The application of this program is illustrated by examples of calculations which have been performed on experimental apparatus for the measurement of sticking coefficients, and on test domes for measuring the performance of diffusion pumps. Author

N66-28267# Ballistic Research Labs., Aberdeen Proving Ground, Md.
CALCULATIONS FOR AIR FLOWS IN DISSOCIATION EQUILIBRIUM
Nathan Gerber and Joan M. Bartos Nov. 1965 50 p refs
(BRL-R-1306; AD-631312) CFSTI: HC $3.00/MF $0.75

Results of calculations carried out for a model of air in dissociation equilibrium are presented in graphical form. The quantities computed are: (1) flow variables (including species concentrations) behind normal and oblique shock waves, (2) flow variables in axisymmetric conical flow fields, (3) stagnation point values of flow variables on the stagnation streamline behind two-dimensional and axisymmetric detached shock waves, and (4) flow variable gradients at the shock wave on stagnation streamlines. Computations are given for the free stream temperatures of 273.16°K and 300°K, free stream pressures of 1.0, .1, .01, .001, and .0001 atmospheres, and a range of initial Mach numbers and cone angles to provide flow field temperatures in the range 3000°K–10,000°K. Brief derivations of the equations employed are given. The present calculations are oriented toward application in experiments in hypersonic flow with ground facilities such as shock tubes and ballistic ranges. In addition, they furnish important supplementary information to theoretical studies of nonequilibrium flows. Author (TAB)

N66-28284# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NOZZLE FOR ACCELERATION OF A TWO-PHASE STREAM
V. D. Venediktov 23 Mar. 1966 6 p Transl. into ENGLISH from Russian patent no. 167205 (Appl. no. 843805/24-6, 24 Jun. 1963) 2 p
(FTD-TT-65-1738/1+2+4; AD-631431) CFSTI: HC $1.00/MF $0.50

The object of the invention is a nozzle for the acceleration of a two-phase stream containing a narrowing, a throat, and an expanding section which is distinguished by the fact that for the purpose of obtaining a uniform structure of the stream in the narrowing section there is located a deflector the walls of which are parallel to the flow of the corking liquid, and the plane of the output section is disposed in the plane of the throat section. Author (TAB)

N66-28302# Naval Ordnance Test Station, China Lake, Calif.
DRAG-REDUCING FLUIDS IN A FREE TURBULENT JET, DECEMBER 1964–JULY 1965
Donald N. Jackley Apr. 1966 26 p refs
(NOTS-TP-4062; NAVWEPS-9053; AD-631209) CFSTI: HC $1.00/MF $0.50

To determine whether drag reduction is the result of turbulence dampening per se, the decay characteristic of a free turbulent jet was investigated. The work was suggested by recent boundary-layer studies showing that fluid drag reduction is caused by the presence of high-molecular-weight polymers in solution. The jet, having all the properties associated with turbulence except those caused by the presence of a wall, provided an ideal tool for the experiment. It was found that in a water solution of drag-reducing polymer, shear stress was reduced in the nozzle but not in the free jet. Drag reduction was therefore concluded to be a phenomenon of the wall because the character of the turbulence that is beyond the influence of the wall resembles the character of the turbulence in a free jet, which was found to be unaffected by the drag-reducing agent. Author (TAB)

N66-28319# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
DIVERGENT TRANSPORT COEFFICIENTS AND THE BINARY COLLISION EXPANSION
L. R. Haines, J. R. Dorfman, and M. H. Ernst Oct. 1965 41 p refs
(Grants DA-ARO(D)-31-124-G-678; AFOSR-141-65)
(AROD-407-69; AD-631808) CFSTI: HC $2.00/MF $0.50

The binary collision expansion for the viscosity of a two-dimensional gas of hard disks is discussed. A divergence appears in the first correction to the Boltzmann equation result. The calculations presented here are exact and free of the difficulties that appear in the earlier discussion of Kawasaki and Oppenheim. The coefficient of the divergence is computed and found to be precisely the same as that found by Sengers by an entirely different method. The origin of the divergence is shown to be exactly the same as that found by Dorfman and Cohen. Author (TAB)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N66-26902# Joint Publications Research Service, Washington, D. C.

COMPUTATION OF THE VERTICAL TURBULENT EXCHANGE COEFFICIENTS OF HEAT IN SEAS AND RESERVOIRS

Ye. P. Anisimova and A. A. Pivovarov *In its* Transl. from Meteorol. i Gidrolog., No. 2, Feb. 1966 24 Mar. 1966 p 15–24 refs (See N66-26900 15-20) CFSTI: $3.00

The coefficient of vertical turbulent heat exchange in natural bodies of water was investigated, based on the assumptions that the propagation of heat is caused both by the vertical turbulent flux and by the flux of radiant energy penetrating to some depth. Equations are developed for the absorption of penetrating solar radiation by the water, and for the coefficient of turbulent heat exchange. Graphs are presented showing diurnal variation of temperature at different depths, dirunal variation of total penetrating solar radiation, and the change with depth of the vertical turbulent heat exchange. It was concluded that the exchange coefficient can be considered virtually constant and equal to 1–1.5 cm^2/sec. The values of the coefficient decrease toward the surface in the upper layers. N.E.N.

N66-26973# Joint Publications Research Service, Washington, D. C.

PHYSICS OF THE UPPER ATMOSPHERE

Chiu-Chang Chao *In its* Transl. on Communist China's Sci. and Technol. 13 May 1966 p 1–8 refs Transl. into ENGLISH from the book "Kao-K'ung Ta-Ch'i Wu'li-Hsueh, Volume I" Peking, Sci. Press, May 1965 p ii–ix (See N66-26972 15-23) CFSTI: $1.00

The title page, content description, preface, and table of contents of this Chinese-language book are presented. Subject matter deals with the structure of the upper atmosphere, the physics of the ionosphere, the photochemical effects in the atmosphere and atmospheric illuminations, the space between the sun and the earth, the exploration of the upper layers, and related techniques. Bibliographies for each chapter are included. M.G.J.

N66-26977# Joint Publications Research Service, Washington, D. C.

RECENT STUDIES IN MARINE GEOPHYSICS

17 Feb. 1966 66 p refs Transl. into ENGLISH from Vopr. Metodiki Glubinnogo Seysmicheskogo Zondirovaniya (Moscow), 1965 p 141–174

(JPRS-34192; TT-66-30633) CFSTI: $3.00

CONTENTS:

1. PROPAGATION OF AIRY WAVES IN SHALLOW WATER DURING DEEP SEISMIC SOUNDING AT SEA Ye. A. Starshinova p 1–22 refs (See N66-26978 15-13)

2. DISTANCE AND DEPTH DETERMINATION IN STUDY OF THE EARTH'S CRUST AT SEA Ye. A. Starshinova p 23–55 refs (See N66-26979 15-13)

N66-26978# Joint Publications Research Service, Washington, D. C.

PROPAGATION OF AIRY WAVES IN SHALLOW WATER DURING DEEP SEISMIC SOUNDING AT SEA

Ye. A. Starshinova *In its* Recent Studies in Marine Geophys. 17 Feb. 1966 p 1–22 refs (See N66-26977 15-13) CFSTI: $3.00

Studies were conducted on the dynamic and kinematic characteristics of airy waves from the viewpoint of their relationship to oceanological conditions. Their possible uses for determining the speed of sound in the bottom, and the distances between the shot and the reception points are also investigated. Details are given on the analysis, which was based on over 350 oscillographic sonic records obtained under different oceanological conditions. Results show: (1) Sonic records obtained by the deep seismic sounding method give important information on the physical properties of the water layer and the upper layer of sediments. (2) The form of the sonic record under different hydrological conditions agrees with the theoretical record, especially in the case of shots and recording on the bottom. (3) The most clearly expressed, stable, and easily identified characteristic of the sonic record in a shallow sea is the airy wave. It was concluded that the airy wave can be used for determining distances between shot and reception points, due to its stable velocity and universal tracing. M.G.J.

N66-26979# Joint Publications Research Service, Washington, D. C.

DISTANCE AND DEPTH DETERMINATION IN STUDY OF THE EARTH'S CRUST AT SEA

Ye. A. Starshinova *In its* Recent Studies in Marine Geophys. 17 Feb. 1966 p 23–55 refs (See N66-26977 15-13) CFSTI: $3.00

The records of sound characteristics of regions with different oceanological conditions were investigated, with methods of geometrical acoustics used in the analysis. Ways of determining distances between shot points and reception points were also considered, based on the various characteristics of the sound record. The method for determining sea depth under the shot points is described, using the arrival time of the acoustic waves reflected from the bottom and the mean vertical speed of sound. Hydrological observations were made to study the changes of the speed of sound in water in vertical and horizontal directions; data analyses show that the maximum changes occur vertically, and that the horizontal variations are small. Based on the characteristics of the sonic records, three large areas are defined: regions of great depth, moderate depth, and shallow area. The principal characteristics representative of each region are described. M.G.J.

N66-26985# Joint Publications Research Service, Washington, D. C.

SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 133

2 Jun. 1966 97 p refs Transl. into ENGLISH from Sino-Soviet Bloc Publ.

(JPRS-35809; TT-61-11147-133) CFSTI: $3.00

Articles gathered from scientific publications of Sino-Soviet bloc countries are presented. Included are abstracts, summaries and occasional full translations of articles on astronomy, meteorology, oceanography, terrestrial geophysics, and upper atmosphere and space research. H.S.W.

N66-27001# Travelers Research Center, Inc., Hartford, Conn.
GENERAL CIRCULATION RESEARCH Final Report, 24 Mar. 1965–23 Mar. 1966
Barry Saltzman and M. Sankar-Rao Mar. 1966 104 p refs (Contract CWB-11057) (Rept.-7042-214)

CONTENTS:

1. CONTINENTAL ELEVATION INFLUENCE ON THE STATIONARY HARMONICS OF ATMOSPHERIC MOTION M. Sankar-Rao p 5–23 refs (See N66-27002 15-13)

2. ON THE INFLUENCE OF THE VERTICAL DISTRIBUTION OF STATIONARY HEAT SOURCES AND SINKS IN THE ATMOSPHERE M. Sankar-Rao p 27–30 refs (See N66-27003 15-13)

3. ON THE THEORY OF THE MEAN TEMPERATURE OF THE EARTH'S SURFACE B. Saltzman p 32–58 refs (See N66-27004 15-13)

4. SURFACE BOUNDARY EFFECTS ON THE GENERAL CIRCULATION AND MACROCLIMATE: A REVIEW OF THE THEORY OF THE QUASI-STATIONARY PERTURBATIONS IN THE ATMOSPHERE B. Saltzman p 61–107 refs (See N66-27005 15-13)

N66-27002# Travelers Research Center, Inc., Hartford, Conn.
CONTINENTAL ELEVATION INFLUENCE ON THE STATIONARY HARMONICS OF ATMOSPHERIC MOTION
M. Sankar-Rao *In its* Gen. Circulation Res. Mar. 1966 p 5–23 refs Repr. from Geofis. Pure Appl. (Milan), vol. 60, 1965 (See N66-27001 15-13)

The effect of lifting of a latitudinally uniform zonal current of air by the continental elevations, on the stationary harmonics of the atmospheric motion, is investigated. Use of spherical harmonics up to the 15th degree is made within the framework of a simple quasigeostrophic linear theory. The results indicate that such an effect, though significant, cannot alone explain the observations. Some other interesting points regarding some of the assumptions involved (e.g., regarding the Coriolis parameter) are discussed. Author

N66-27003# Travelers Research Center, Inc., Hartford, Conn.
ON THE INFLUENCE OF THE VERTICAL DISTRIBUTION OF STATIONARY HEAT SOURCES AND SINKS IN THE ATMOSPHERE
M. Sankar-Rao *In its* Gen. Circulation Res. Mar. 1966 p 27–30 refs Repr. from Monthly Weather Rev., v. 93, no. 7, Jul. 1965 (See N66-27001 15-13)

Within the framework of a quasi-geostropic model, the influence of different kinds of vertical profiles of diabatic heating on a stationary harmonic of the atmosphere is studied. Except in the cases in which there is a diabatic heating reversal in the upper layers of the atmosphere, the results show qualitative similarity, especially in phase. This lends support to the somewhat arbitrarily selected vertical profiles of diabatic heating used in many previous studies. Author

N66-27004# Travelers Research Center, Inc., Hartford, Conn.
ON THE THEORY OF THE MEAN TEMPERATURE OF THE EARTH'S SURFACE
Barry Saltzmann *In its* Gen. Circulation Res. Mar. 1966 p 32–58 refs (See N66-27001 15-13)

A formula for the temperature of the earth's surface is derived from a simple semi-empirical representation of the surface heat balance. The results indicate the usefulness of such a representation as an interfacial sea–air–land boundary condition for dynamical models of macroclimate. Author

N66-27005# Travelers Research Center, Inc., Hartford, Conn.
SURFACE BOUNDARY EFFECTS ON THE GENERAL CIRCULATION AND MACROCLIMATE: A REVIEW OF THE THEORY OF THE QUASI-STATIONARY PERTURBATIONS IN THE ATMOSPHERE
Barry Saltzman *In its* Gen. Circulation Res. Mar. 1966 p 61–107 refs (See N66-27001 15-13)

Overall structural guidelines are outlined for a quasi-steady state theory of the macroclimate to explain atmospheric perturbations, and details are presented of the component of this theory which represents the atmospheric response to axisymmetric lower boundary conditions. The set which has been taken as the basis for most theoretical studies of the mean waves in the atmosphere is described, various equations of motion are considered, approximations used in these atmospheric studies are given, and boundary conditions are discussed. Solutions are included for the response to adiabatic flow over mountains as well as to asymmetric surface heating. M.W.R.

N66-27007# Alaska Univ., College. Geophysical Inst.
COMPUTED HF AURORAL BACKSCATTER TRACES FOR VARIOUS DISTANCES
Howard F. Bates Feb. 1966 41 p refs (UAG-R-174)

Computed ionospheric backscatter traces in the HF portion of the radio spectrum are illustrated for a number of distances between the auroral belt and the observing radar. The type, frequency range, and observed scattering height of HF auroral backscatter traces are strongly dependent upon the ionospheric propagation and conditions existing between the auroral belt and the observer. Backscatter echoes produced in a given region of space by a single backscattering mechanism can have completely different range versus frequency characteristics when observed at sites located at different distances from the scattering region. Even though a given band of auroral-belt irregularities extends through both the E and F regions, it is possible that only E-scatter is detected at one distance, and F-scatter at another. Trace type, scattering height, and frequency range of the observed backscatter echoes are strongly dependent upon the distance between the auroral belt and the observer. Author

N66-27023# Fleet Numerical Weather Facility, Monterey, Calif.
SHORT-TERM FLUCTUATIONS OF SEA SURFACE TEMPERATURE, THEIR MAGNITUDES, CAUSES AND EFFECTS
Paul M. Wolff, Tavio Laevastu, and John Russell (Naval Oceanog. Office) 1 Feb. 1965 21 p refs (TN-6)

A preliminary study was made of the short-term fluctuations of sea surface temperature, their magnitudes, and their causes. This was conducted in order to shed further light on the question of whether the sea surface temperature fields are persistent for relatively long periods of time or change from day to day as a result of the action of atmospheric forces at the surface. Hemispheric 12-hour analyses, surface pressure analyses, and BT messages were used for this purpose, with the areas of study selected where the density of ship reports are relatively high. C.T.C.

N66-27027*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A MEASUREMENT OF THE ULTRAVIOLET NIGHTGLOW SPECTRUM

John P. Hennes [1965] 19 p refs Submitted for Publication (NASA-TM-X-56822) CFSTI: HC $1.00/MF $0.50 CSCL 04A

The spectrum of the ultraviolet night airglow from 2300–3800Å has been recorded with 12Å resolution by a fast spectrograph carried on an Aerobee rocket. All of the features observed can be attributed to the molecular oxygen Herzberg band system ($A^3\Sigma_u^+ - X^3\Sigma_g^-$) with the exceptions of the OI transauroral line at 2972Å and five unidentified bands, all lying at wavelengths greater than 3400Å. The Herzberg 7,0 band at 2519Å marks the shortest wavelength emission feature and no emission from upper states with $v' > 7$ is observed. The total zenith emission rate in the wavelength interval photographed is roughly estimated as 600R. Details of the spectrograph are described and a comparison of the nightglow spectrum with published laboratory afterflow and ground observed nightglow spectra is made.

Author

N66-27030*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE EQUATORIAL GEOMAGNETIC ANOMALY AND ITS ASSOCIATED CURRENT SYSTEM

Richard A. Goldberg Jul. 1965 23 p refs Submitted for Publication

(NASA-TM-X-56736) CFSTI: HC $1.00/MF $0.50 CSCL 04A

It is suggested that the equatorial F region electron density distribution (the geomagnetic anomaly) is simply the natural steady state distribution one would expect for charged fluids under the influence of gravitational, electric, and magnetic fields and production and loss, when interaction with the neutral medium is negligible. It is shown that this steady state distribution maintains itself by means of a longitudinal current system, and a study of the properties of this longitudinal current system leads to a technique for its complete mapping in the upper F region of the ionosphere. Quite importantly, it is shown that the latitudinal electron density distribution that characterizes the equatorial anomaly cannot exist when the longitudinal current system is absent. Author

N66-27056*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ELECTRON DENSITIES AND SCALE HEIGHTS IN THE TOPSIDE IONOSPHERE: ALOUETTE I OBSERVATIONS IN MIDLATITUDES, SUMMER 1963; WINTER 1963–1964

John O. Thomas, Michael J. Rycroft, and Lawrence Colin Washington, NASA, 1966 658 p refs

(NASA-SP-3026) CFSTI: HC $6.50/MF $3.00 CSCL 04A

This volume presents data on electron density (N) and plasma scale height (H) at a series of heights (h) and times (t) in the topside ionosphere. The quantity H is defined as

$$H = -\frac{N}{(dN/dh)}$$

The tabulated N(h,t) and H(h,t) data were computed from Alouette I topside ionograms. An overlapping polynomial method of analysis which has been described elsewhere was used. The calculations were programed for an electronic digital computer. The complete program of reduction is shown, and includes results over a range of dip latitudes extending from approximately 20° to 80° north for summer and winter months at a sunspot minimum epoch of the solar cycle. The curves presented show the winter and summer variations of the electron density (N) and scale height (H) with local time, (diurnal variations), and dip latitude (latitude variations) at a series of altitudes (h) in the topside ionosphere as calculated from the tabulated values of N and H. Author

N66-27058*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

DETERMINATION OF MEAN ATMOSPHERIC DENSITIES DURING MINIMUM SOLAR ACTIVITY BY MEANS OF THE EXPLORER XIX SATELLITE

James A. Mullins, Gerald M. Keating, David S. Mc Dougal, and Edwin J. Prior Washington, NASA, Jun. 1966 29 p refs (NASA-TN-D-3432) CFSTI: HC $1.00/MF $0.50 CSCL 04A

Atmospheric densities are derived from changes in the energy of the Explorer XIX satellite, a 12-foot-diameter inflatable sphere. The method of density determination is described in detail. The quantities describing the variation of density with altitude are determined from the Jacchia model atmosphere by means of an iteration procedure. Densities were evaluated between 1/2 and $\sqrt{3}/2$ density scale heights above perigee, depending upon the exospheric temperature. Equations are given for the solar radiation force on the Explorer XIX and for the aerodynamic drag coefficient as a function of perigee altitude in an atmosphere with low solar heating. Tabulated densities span a period of approximately seven months before and after the month of minimum solar activity during the present solar cycle, and inferred exospheric temperatures at minimum solar activity were less than 700°K. Also tabulated are: Explorer XIX orbital elements, some parameters useful in analysis of density variations, atmospheric parameters assumed for the calculation of densities, and exospheric temperatures derived from the density points. Author

N66-27062*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.

THE RESPONSE OF AN UNBOUNDED ATMOSPHERE TO POINT DISTURBANCES. II: IMPULSIVE DISTURBANCES

Shoji Kato [1965] 21 p refs Submitted for Publication (NASA-TM-X-56782) CFSTI: HC $1.00/MF $0.50 CSCL 04A

The response of an unbounded and isothermal atmosphere to a point impulse of force is studied. Fronts of disturbances propagate with two different speeds corresponding to acoustic waves and to gravity waves. The distributions of kinetic energy density in the two wakes behind the two fronts are calculated. A striking result is that behind the acoustic front, the radiation density is very intense above and below the source, if the atmosphere is sufficiently stable to convection. This result may be of interest in connection with the formation of spicule structures in the solar upper chromosphere. Author

N66-27126# California Univ., Livermore. Lawrence Radiation Lab.

THE PARTICLE SIZE DISTRIBUTION AND BULK PERMEABILITY OF OIL SHALE RUBBLE

D. B. Lombard 12 Aug. 1965 15 p refs

(Contract W-7405-ENG-48)

(UCRL-14294) CFSTI: HC $1.00/MF $0.50

A tabulation of the size distribution of fragments of oil shale shattered in a roof fall at the U.S.B.M. mine at Rifle, Colorado, was obtained by counting particles in photographs of the rubble. This distribution is approximately lognormal. The theory of particle statistics was then invoked in a calculation of the bulk permeability of the rubble. In an extrapolation to a hypothetical underground nuclear chimney

in oil shale, it is estimated that the bulk permeability of the chimney rubble would be about 3×10^{-5} to 3×10^{-4} ft^2. Author (NSA)

N66-27202*# National Aeronautics and Space Administration, Washington, D. C.
OBSERVATION DATA OF THE SCIENTIFIC-RESEARCH DRIFTING STATIONS "SEVERNYY POLYUS-6" AND "SEVERNYY POLYUS-8", 1959-1960 [MATERIALY NABLYUDENIY NAUCHNO-ISSLEDOVATEL'SKIKH DREYFYUSHCHIKH STANTSIY "SEVERNYY POLYUS-6" I "SEVERNYY POLYUS-8", 1959/60 GODA]
N. A. Milyayev, ed. Dec. 1963 11 p Transl. into ENGLISH from Tr. Arkticheskogo i Antarkt. Nauchno-Issled. Inst. (Leningrad), v. 265, 1963 p 4-9
(NASA-TT-F-8720) CFSTI: HC $1.00/MF $0.50 CSCL 08N

A complex study was made of the central Arctic in 1959-1960 by the two drifting stations, the Severnyy Polyus-6 and the Severnyy Polyus-8. Both stations carried out regular magnetic and ionospheric observations. The geophysical observations at both stations are regarded as highly valuable as they shed light on the little explored Arctic regions. In addition to the results of the geomagnetic observations, tables of the processed data on the ionospheric observations are presented. C.L.W.

N66-27206*# Consultants and Designers, Inc., Arlington, Va.
ON THE ACCOUNTING OF SATELLITE-BORNE RADIATION MEASUREMENTS IN A NONADIABATIC MODEL OF ATMOSPHERIC MOTIONS [K UCHETU REZUL'TATOV RADIATSIONNYKH IZMERENIY SO SPUTNIKOV V NEADIABATICHESKOY MODEL ATMOSFERNYKH DVIZHENIY]
M. E. Shvets and B. E. Shneyerov 22 Nov. 1963 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Geofiz. (Moscow), v. 152, no. 3, 21 Sep. 1963 p 598-610
(Contract NAS5-2078)
(NASA-TT-F-8642; ST-AM-10070) CFSTI: HC $1.00/MF $0.50 CSCL 04A

A method for calculating the effect of heat influx on the development of atmospheric flows is presented. To calculate the value of the inflow, this method uses data obtained with the aid of meteorological satellites. R.T.K.

N66-27213*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
RECOMBINATION IN THE NIGHTTIME F-REGION FROM INCOHERENT SCATTER MEASUREMENTS
J. S. Nisbet and D. Mc Crory [1965] 15 p refs Presented at NATO Advanced Study Inst. on Electron Density Profiles in the Ionosphere and Exosphere, Finse, Norway Submitted for Publication
(NsG-134-61)
(NASA-CR-57303) CFSTI: HC $1.00/MF $0.50 CSCL 04A

Previous measurements of recombination coefficients in the F layer were made using ion density profiles derived from reduced ionograms. Uncertainties resulted due to the lack of information on the profile of the top of the layer, on the temperatures of electrons, ions and neutral particles and about the profiles in the lower F layer at night. Profiles obtained have been used to study the nighttime recombination. It is shown that large changes in the electron ion temperature ratio do occur at night in winter under low sunspot conditions up to about 0200 hours. A considerable improvement in the consistency of the results is obtained from the use of the incoherent scatter measurements and it is possible to derive recombination coefficients with reasonable agreement from hour to hour from twenty minutes of data. Electron ion temperature ratios of greater than unity were observed throughout the night raising the question of nighttime production and the effect of this on the results is discussed. Author

N66-27215*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
ELECTRON MICROPROBE STUDY OF SPHERULES FROM ATLANTIC OCEAN SEDIMENTS
Richard A. Schmidt and Klaus Keil [1965] 27 p refs Submitted for Publication
(NASA-TM-X-56552) CFSTI: HC $2.00/MF $0.50 CSCL 08J

Spherules recovered from the Atlantic Ocean sediments were studied by means of electron microprobe techniques. The spherules were embedded in clear plastic and polished to eliminate terrestrial alteration of particle surfaces and the introduction of contaminants. Chemical analyses were performed using a stationary electron beam and by sweeping the electron beam over a selected area and for the characteristic X-ray intensities. The spherules were classed into 4 groups based on their textures and compositions: (1) magnetite laths containing Ni and Co, surrounded by Si-rich films at grain boundaries; (2) homogeneous magnetite, with small amounts of Ni and Co; (3) magnetite with Si-rich lamellae in a dendritic intergrowth; and (4) irregular particles commonly with low Fe content, but occasionally with minute Ni-rich flakes. Tabulated results and photographs of the spherules are included. It was concluded that spherules in the first two groups are of meteoritic origin representing ablation droplets swept from meteorites during passage though the earth's atmosphere. N.E.N.

N66-27224*# National Aeronautics and Space Administration, Washington, D. C.
THE SPECTRAL ALBEDO OF THE SNOW AND VEGETATIVE COVER
K. Ya. Kondrat'yev, Z. F. Mironova, and L. V. Deyeva Sep. 1963 33 p refs Transl. into ENGLISH from Mezhdunar. Geofiz. God. Leningr. Gos. Univ., Sb. Statei i Materialov (Leningrad), 1960 p 35-38
(NASA-TT-F-8487) CFSTI: HC $2.00/MF $0.50 CSCL 08L

The spectral albedo of snow and of a vegetative cover is reviewed. A common characteristic of the albedo of dry, pure snow on cloudless days was that of a maximum albedo in the shortwave region, and an increasing albedo in the region near the infrared spectrum. A monochrometer enabled the measurement of the wavelength up to 800 millicron. Results indicate an increasing albedo in the region of $\lambda > 650$ millicron which means that a maximum reflection should occur near the 800 millicron wavelength. The variability of the spectral distribution of the albedo in the case of fresh snow is particularly important for shortwaves of $\lambda < 450$ millicron. Intense variability of the spectral albedo is also typical of melting and impure snow. If a more or less marked increase in the albedo in the direction of short and long waves is, on the average, characteristic of dry and pure snow, the opposite is, as a rule, true of impure or wet snow. Naturally, the spectral albedo of all wavelengths diminishes with the increasing contamination and wetness of the snow. The roughness of the snow cover also has a considerable effect on the magnitude of the albedo. The snow albedo diminishes, in all wavelengths under consideration, with increasing snow roughness. Also, the appearance of high clouds apparently reduces the albedo in the direction of the shortest and longest waves and produces two maxima in the intermediate region of the spectrum. Low albedo

values are characteristic of different types of green plants (succulent grass cover, green tree leaves, etc.) in the visible region of the spectrum with a small maximum in the area of 500 to 550 millicron and a minimum in the chlorophyll absorption band (about λ=650 millicron). The albedo is greatly enhanced to a wavelength of about 700 millicron. The albedo retains its high magnitude up to a wavelength of 1 micron. When the vegetation turns yellow, the minimum reflection in the region of chlorophyll is no longer observable. I.v.L.

N66-27230*# Flight Safety Foundation, Inc., New York.
CLEAR AIR TURBULENCE
Paul Rosenberg, M. Gould Beard, and Henry T. Harrison Dec. 1965 230 p refs
(Contract NSR-33-026-001)
(NASA-CR-62028) CFSTI: HC $6.00/MF $1.25 CSCL 04A

This report was prepared to assist NASA in keeping abreast of research and development projects directed toward the alleviation of problems posed by flight in clear air turbulence (CAT). Included are a poll of industry for information about development activities on CAT detection, a chronological listing of conferences and interviews, reports on conferences and interviews, airborne CAT detection devices in active flight testing, CAT incidents, meteorological developments relative to CAT, and economic aspects of turbulence in airline operations. A bibliography is also included which contains references to the physical, meteorological, and operational aspects of air turbulence. R.N.A.

N66-27312*# Geophysics Corp. of America, Bedford, Mass.
IONOSPHERIC SIMULATOR SURVEY
A. E. Barrington, E. D. Schultz, A. Sharma, and J. O. Sullivan Washington, NASA, May 1966 148 p refs
(Contract NAS12-11)
(NASA-CR-482) CFSTI: HC $4.00/MF $1.00 CSCL 04A

A survey was conducted of the state-of-the-art of simulating the D and E regions of the ionosphere, specifically identifying those parameters capable of being simulated simultaneously. Techniques and/or methods for ionospheric simulation were evaluated, including those used in existing facilities plus any theoretically applicable approaches, and the most promising were selected. The necessary equipment to simulate the parameters was identified. The survey of existing facilities showed that no large scale concentrated efforts are in progress to simulate simultaneously the many pertinent parameters of the ionosphere. The only active programs are concerned with the production of low energy space charge neutral beams to simulate the density of positive ions as viewed by a satellite. The survey demonstrated that charged particles, ultraviolet and X-ray radiation, and atomic oxygen can be simulated with existing methods from 50 to 160 km. The conceptual design of an ionospheric simulation facility was derived, and the equipment was identified for the simultaneous simulation of charged particle density, solar ultraviolet and X-ray flux, and the production of atomic oxygen. R.N.A.

N66-27398# California Univ., Livermore. Lawrence Radiation Lab.
NUMERICAL SIMULATION OF SEISMIC DISTURBANCES
J. T. Cherry and W. R. Hurdlow Jan. 1965 31 p refs
(Contract W-7405-ENG-48)
(UCRL-7929) CFSTI: HC $2.00/MF $0.50

The results from a Lagrangian numerical scheme of calculating cylindrically symmetric, elastic-plastic, transient disturbances are presented. The numerical technique involves transforming the Eulerian equations of motion containing a cylindrically symmetric stress tensor into Lagrangian coordinates. These transformed equations are then differenced in the Lagrangian coordinate system. Therefore, a given instantaneous stress field determined the accelerations of the points in the Lagrangian mesh. These accelerations are allowed to act over a small time step so that the mesh becomes distorted. This distortion determines the change in strain at a point; the strain change is related to a stress change by Hooke's law. This new stress is used to determine new accelerations. If the material behaves plastically, then the stresses are adjusted so that a Von Mises yield condition is satisfied. Five numerical solutions of various elastic-plastic wave propgation problems are presented and are discussed along with their corresponding analytic and experimental solutions. A shear and tensile failure mechanism is presented that is consistent with the continuum hypothesis.
Author (NSA)

N66-27424# American Meteorological Society, Boston, Mass.
SOME RESULTS OF CALCULATION OF THE RADIATIONAL VARIATION OF TEMPERATURE IN THE ATMOSPHERIC BOUNDARY LAYER [NEKOTORYE REZUL'TATY RASCHETA RADIATSIONNOGO IZMENENIIA TEMPERATURY V POGRANICHNOM SLOE ATMOSFERY]
R. M. Kazhdan and F. N. Shekhter Jan. 1966 16 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 127, 1962 p 26-34
(Contract AF 19(628)-3880)
(TT-66-60834; AD-630552) CFSTI: HC $1.00/MF $0.50

The results of calculation of the radiational variations of temperature are analyzed for various atmospheric stratifications. In the presence of superadiabatic lapse rates and temperature inversions in the atmospheric surface boundary layer, the thermometric conductivity leads to a marked instability near the ground. Author (TAB)

N66-27461# Massachusetts Inst. of Tech., Cambridge. Dept. of Geology and Geophysics.
VARIATIONS IN ISOTOPIC ABUNDANCES OF STRONTIUM, CALCIUM, AND ARGON AND RELATED TOPICS Thirteenth Annual Progress Report, 1965
P. M. Hurley, H. W. Fairbairn, W. H. Pinson, Jr., P. Kolbe, J. A. Philpotts et al 1 Dec. 1965 112 p refs
(Contract AT(30-1)-1381)
(MIT-1381-13) CFSTI: HC $4.00/MF $0.75

Information is given on age estimations and isotopic abundances in New England rocks, tektites, Canadian rocks and volcanic material, and sea and surface waters. Rubidium, strontium, argon, potassium, and calcium isotopes were primarily studied. NSA

N66-27491*# National Aeronautics and Space Administration, Washington, D. C.
SHOCK COMPRESSION OF PERICLASE AND QUARTZ AND THE COMPOSITION OF THE ABYSSAL MANTLE OF THE EARTH [UDARNOYE SZHATIYE PERIKLAZA I KVARTSA I SOSTAV NIZHNZY MANTII ZEMLI]
L. V. Al'tshuler, R. F. Trunin, and G. V. Simkov Apr. 1966 16 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Fiz. Zemli (Moscow), no. 10, 1965 p 1-6
(NASA-TT-F-10101) CFSTI: HC $1.00/MF $0.50 CSCL 08G

Results are given of an investigation of the shock compressibility of periclase and quartz up to pressures of about 2.5 mbar. The shock adiabatic curves of periclase, a rutile-like modification of quartz, and the isotherms of these substances for temperatures of 0°K and 4000°K are calculated

from the experimental data obtained. By comparing the compression of the earth with the P-ρ diagram, conclusions are drawn as to the chemical composition of the deep mantle. Author

N66-27514# Argonne National Lab., Ill.
ENVIRONMENTAL RADIOACTIVITY AT ARGONNE NATIONAL LABORATORY, 1964
J. Sedlet and F. S. Iwami Oct. 1965 45 p
(Contract W-31-109-ENG-38)
(ANL-7104) CFSTI: HC $2.00/MF $0.50

Results of the enviromental monitoring program at Argonne National Laboratory during 1964 are presented. The purposes of the program are to measure the natural radioactive content of the ANL site and its surroundings, and to determine the origin, identity, and magnitude of any radioactivity not naturally present. Of primary interest is the detection of radioactive materials released to the environment as a result of Argonne operations. The radioactive content of the environment was determined by radiochemical analyses, total activity measurements, and gamma-ray spectrometric measurements performed on several types of natural materials collected on the ANL site and from locations up to 100 miles from the site. The frequency of sampling decreased with increasing distance from the Laboratory. The sampling locations are described in Part II of this report. Since air and water are the most probable media for spreading radioactive contamination, the sampling program concentrated on these materials. Argonne waste water is discharged into Sawmill Creek, which in turn flows into the Des Plaines River, and special emphasis was placed on these streams.
Author (NSA)

N66-27554# Brookhaven National Lab., Upton, N. Y. Information Div.
GLOBAL FALLOUT OF NUCLEAR EXPLOSION PRODUCTS
V. N. Lavrenchik [1965] 44 p Transl. into ENGLISH from the book "Global'noye Vypadeniye Produktov Yadernykh Vzrynov" Moscow, Atomizdat, 1965, ch. 3
(BNL-TR-42) CFSTI: HC $2.00/MF $0.50

A review is presented on sample collection and determination of activity of fallout on the earth, in atmosphere, and in the stratosphere. Special attention is given to the determination of ^{14}C and tritium. Approximately 100 references are cited. NSA

N66-27570# Teledyne, Inc., Alexandria, Va. Earth Sciences Div.
PERTURBATION THEORY FOR THE INVERSION OF BODY WAVE TRAVEL-TIME DATA
C. B. Archambeau and E. A. Flinn 5 Apr. 1966 41 p refs *Its* Seismic Data Lab. Rept.-142
(Contract AF(657)-15919; ARPA Order 624; Proj. Vela Uniform)
(AD-630699) CFSTI: HC $4.60/MF $0.50

Estimation of the internal elastic structure of the earth from body wave travel times ordinarily uses both arrival time data and the slope of a curve fitted to the observed travel times. There are well known difficulties in fitting such curves, particularly in cases where the observed travel times suggest a multivalued time function. A perturbation method is described in which an initial velocity distribution, which may be chosen to be in agreement with surface wave dispersion data over the region in question, is perturbed iteratively until the theoretical travel time function is in agreement, in the least-squares sense, with the observed data. The method does not require any estimate of the curve slope or multiplicity, nor does it require a particularly dense and complete data coverage over the entire distance range. Several phases can be used simultaneously. Author (TAB)

N66-27573# Miami Univ., Coral Gables, Fla. School of Engineering.
MEASUREMENT OF NATURAL PARTICULATE FALLOUT ONTO HIGH POLAR ICE SHEETS. PART I: LABORATORY TECHNIQUES AND FIRST RESULTS
Henri Bader, Wayne L. Hamilton, and Paul L. Brown Hanover, N. H., Army Cold Reg. Res. and Eng. Lab., Nov. 1965 92 p
(Grant DA-ENG-27-021-62-G2)
(CRREL-RR-139, Pt. I; AD-630902) CFSTI: HC $3.00/MF $0.75

The paper describes specifications for the laboratory, the purification of tap water for use as wash water and in making moderately clean NaCl solutions, the cleaning of glassware, the preparation and cleaning of NaCl solutions, the processing of ice samples, the measurement of electrical conductance, the Goulter particle counter and its use, and some of the underlying principles. The equipment used is identified and some first results obtained on cores from Byrd Station, Antarctica, are presented. Author (TAB)

N66-27580# Wisconsin Univ., Madison. Dept. of Geology.
COMPUTER METHODS OF ANALYZING AEROMAGNETIC DATA Final Report
Richard J. Wold and Thomas R. Wolfe Jan. 1966 88 p refs
(Contract Nonr-1202(25))
(RR-66-1; AD-630783) CFSTI: HC $3.00/MF $0.75

Digitally recorded aeromagnetic data can be read directly by a computer, the readings converted to values in gammas, any erroneous readings eliminated, and the regional field due to the dipole nature of the geomagnetic field removed. The data may then be profiled on any map projection and scale. Also surface fits of various degree polynomials can be made to the original data and contoured by an X-Y plotter. Finally differences between various fitted surfaces can be contoured. Author (TAB)

N66-27811# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
SNOW STUDIES IN ANTARCTICA
Anthony J. Gow Nov. 1965 27 p refs
(CRREL-RR-177; AD-631718) CFSTI: HC $2.60/MF $0.50

The seasonal distribution of snow at the south pole and its relationship to stratigraphy was investigated in pits dug beside a number of four-year old accumulation stakes. Results show that conventional stratigraphic methods yield thoroughly reliable values of accumulation rates, even hiatuses in accumulation can be identified from the intensity of sublimation of layers of depth hoar. Such hiatuses can be attributed generally to the prolonged absence of accumulation rather than to widespread scouring of preexisting layers of snow. The bulk of the year's accumulation is deposited as dunes during winter. Most dunes are subsequently transformed into linear sastrugi so that by winter's end the amplitude of the surface relief frequently exceeds the thickness of snow accumulated annually. During the summer, however, these dunes and sastrugi are gradually worn down by a process of sublimation-deflation. This leveling of the surface relief is believed to be the significant factor in the formation of the remarkably uniform stratigraphy observed in pits at the south pole. An examination of bullet crystals in precipitation at the south pole indicates that combinations of bullets originate as primary growth structures

and that individual bullets are formed as a result of the disintegration of these primary growth forms rather than by independent crystallization of pyramidally terminated columns. Three years' measurements of snow accumulation on undulating surfaces around Byrd Station, Antarctica, indicate that the undulations are tending to be filled in. These results are discussed in the light of current knowledge of the origin and migration of such features. Author (TAB)

N66-27718# Air Force Cambridge Research Labs., Bedford, Mass.
REPORT ON RESEARCH AT AFCRL, JULY 1963–JUNE 1965
Sep. 1965 319 p refs
(AFCRL-65-595; AD-631411) CFSTI: HC $7.00/MF $1.50

Summaries are given of research in the following fields: upper atmosphere physics, microwave physics, space physics, terrestrial sciences, optical physics, data sciences, meteorology, solid state, aerospace instrumentation. TAB

N66-27722# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
STRENGTH STUDIES OF SNOW
Malcolm Mellor and James H. Smith Jan. 1966 28 p refs
(CRREL-RR-168; AD-631717) CFSTI: HC $2.60/MF $0.50

Strength measurements were made on some 650 samples of homogeneous snow prepared under controlled conditions, primarily to investigate the effect of temperature variation. Comparative measurements were made on ice and frozen sand, and the variation of ram hardness with temperature was examined. The results are discussed in terms of surface chemistry effects at crystal boundaries. The inadequacy of density measurements for describing grain structure is discussed. Author

N66-27724# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
SOME PHYSICAL AND MECHANICAL PROPERTIES OF POLAR SNOW
Rene O. Ramseier Feb. 1966 29 p refs Sponsored by NSF
(CRREL-RR-116; AD-631685) CFSTI: HC $2.60/MF $0.50

Specimens of snow from the south pole were tested to investigate air permeability, ultimate compressive strength, and dynamic Young's modulus as a function of density. Anisotropy in a single layer of snow (snow between two summer crusts) was found in all three properties. Comparison with data for snow from site II, Greenland, showed an empirical relation for both areas. Air permeabilities are different at the two sites because of time and meteorological effects. Author

N66-27789# Michigan Univ., Ann Arbor. Willow Run Labs.
VELA UNIFORM RESEARCH PUBLICATIONS
15 Feb. 1966 18 p refs *Its* VESIAC Bull. No. 37
(AD-631055) CFSTI: HC $1.60/MF $0.50

Brief abstracts are presented of research reports in the following areas: the effect of focal depth on seismic pulses; a study of explosion generated seismic waves; seismicity in the southeastern United States; crystal structure in the western United States from multi-mode surface wave dispersion; the effect of the continental margin in southern California on Raleigh wave propagation; the use of optical masers as transducers for pendulum and strain seismographs; matrix-multiply detection processing of array data; a review of long range earth-strain measurement techniques for providing earthquake warnings; asymptotically optimum multidimensional filtering for sampled data processing of seismic arrays; scattering from bodies of revolution; variations in short period records from Canadian seismograph stations; the utilization of tripartite seismic stations in France; high frequency seismometry; seismic observations during experimental explosions; checking the sensitivity of seismic recording channels; the relationships between the focal depth of an earthquake and isoseismic lines; and determination of the azimuth of the epicenter during the registration of local earthquakes. H.S.W.

N66-27798# Teledyne, Inc., Alexandria, Va. VED Earth Sciences Div.
LONG RANGE SEISMIC MEASUREMENTS—CHARCOAL
Don M. Clark 10 Sep. 1965 30 p refs
(Contract AF 33(657)-15919; ARPA Order 624; Proj. Vela Uniform)
(Rept.-138; AD-631043) CFSTI: HC $2.00/MF $0.50

An analysis of seismological data from an underground nuclear explosion as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel-times and amplitudes of P, Pg, Lg, and surface waves are included along with other unidentified phases. Author (TAB)

N66-27810# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
ON THE CALCULATION OF WIND WAVE ELEMENTS IN THE CASE OF VARIABLE WIND
I. S. Brovikov 29 Mar. 1966 12 p refs Transl. into ENGLISH from Tr. Gos. Okeanograf. Cheskii Inst. (Moscow), no. 38, 1957 p 3–10
(Contract NOw-62-0604-c)
(TG-230-T471; AD-631014) CFSTI: HC $1.60/MF $0.50

In computing the elements of wind waves for variable winds it is assumed that the wind energy transmitted by a wave surface on a sea is proportional to the square of the wind velocity. A part of the energy maintains wind waves and their development, another part is dissipated because of viscosity and turbulent motion. The computation of energy dispersion is determined by means of a formula of the semi-empirical theory of turbulence. From the intensity of dissipated energy and the expression for wind energy transmitted by the wave surface the energy balance equation is formulated and solved. Author (TAB)

N66-27829# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SEISMIC DISCRIMINATION Fourth Semiannual Technical Summary Report, 1 Jul.–31 Dec. 1965
Paul E. Green, Jr. 15 Mar. 1966 58 p refs
(Contract AF 19(628)-5167; ARPA Order 512)
(ESD-TDR-65-597; AD-630559) CFSTI: HC $3.00/MF $0.75

The experimental Large Aperture Seismic Array (LASA) in Montana was put into operation and has been used for routine monitoring and data recording. Most of the physical elements of the system are working more reliably than had been anticipated. Research and experimentation with various array processing techniques are under way using LASA data. Results on automatic event detection and location are discussed. Both these sets of investigations are approaching the point at which the LASA capabilities can be established, the signal processing hardware design can be finalized, and a design of a possible global netowrk of LASA's can be worked out, should it be needed. The large array is a signal improvement system whose outputs are to be used for nuclear test monitoring and research on the solid earth.

Early results are reported. Two miscellaneous studies of seismic instrumentation are reported; a survey of electromagnetic means of measuring long-baseline earth strains, and a comparative critique of the noise performance of several methods of amplifying near dc signals. A cumulative list of publications in this program is also presented.
Author (TAB)

N66-27855# Michigan Univ., Ann Arbor. Meteorological Labs.
VISUAL RESOLUTION AND OPTICAL SCINTILLATION OVER SNOW, ICE AND FROZEN GROUND, PART II
Donald J. Portman, Edward Ryznar, and Floyd C. Elder Hanover, N. H., CRREL, Oct. 1965 52 p refs
(Contract DA-11-190-ENG-78)
(CRREL-RR-111, Pt. 2; AD-630603) CFSTI: HC $3.00/MF $0.50

Data obtained over various surfaces were analyzed to determine relationships between visual resolution and meteorological conditions and scintillation (intensity and frequency) and meteorological and surface conditions. The principal results obtained over snow and frozen ground showed that visual resolution, for turbulent flow in stable stratification, (1) deteriorated systematically as the vertical temperature gradient increased, (2) deteriorated with clear skies as the wind speed increased up to about 5 mph and then improved at higher wind speeds, and (3) was optimum and nearly independent of wind speed during low overcast cloudiness. Over a snow-free ice surface and with air temperatures below freezing, only minor scintillation was observed. The scintillation data obtained over ice are interpreted with regard to wind and temperature above the ice and to the heat conducted upward through the ice. A photographic method to measure resolution is described and some results are presented. Power spectra of scintillation over a different surfaces are shown and discussed in relation to various meteorological parameters. These and other relations are discussed and equipment and measurement procedures are described. Author (TAB)

N66-27856# Cornell Univ., Ithaca, N. Y. Surveying Dept.
ANALYTIC AEROTRIANGULATION: TRIPLETS AND SUB-BLOCKS INCLUDING USE OF AUXILIARY DATA, PHASE III Final Technical Report, 1 Mar. 1964-30 Sep. 1965
James M. Anderson, Richard L. Eslum, and Arthur J. McNair [1965] 140 p refs
(Contract DA-44-009-AMC-502(X))
(AD-631072) CFSTI: HC $13.60/MF $1.00

The feasibility of using triplets and sub-blocks as opposed to the conventional stereopairs is investigated. A procedure for triplet aerotriangulation consisting of: (1) triplet relative orientation; (2) triplet assembly; and (3) transformation to ground control has been developed, programmed and tested using FORTRAN language and proven suitable for a 10k computer. The program uses the coplanarity equation for the condition for relative orientation. Both fictitious and real photographic data were tested. Triplets are proven to be much stronger than conventional stereopairs for extending control. A procedure for ninephotograph sub-block aerotriangulation consisting of: (1) sub-block relative orientation and coordinate computation; (2) sub-block assembly for a pair of sub-blocks; and (3) transformation to ground control has been developed, programmed and tested using FORTRAN language with fictitious photography on a 32 k electronic computer. The program is based on the colinearity equation and also will perform aerotraingulation of strips using triplets. It requires 60 percent side lap of strips and provides many advantages over a general block triangulation solution. Theoretical developments are presented which allow incorporation of auxiliary exposure station data in the sub-block relative orientation. Author (TAB)

N66-27894# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
DIRECT SHEAR STUDY ON SNOW PROCEDURE AND DATA
G. E. H. Ballard, E. D. Feldt, and S. R. Toth Dec. 1965 16 p ref
(CRREL-SR-92; AD-631140) CFSTI: HC $1.60/MF $0.50

In order to gain a greater insight into the behavior of snow and to provide a body of data for the purpose of checking theoretical developments in snow mechanics, a direct shear experiment was performed on a standardized disaggregated snow, investigating the effect of porosity, age-hardening time, normal stress, and temperature on the shear strength. Incidental to the direct shear test, consolidation, frictional resistance, and strain data were recorded. This report describes the experimental procedure, and provides the data obtained from the experiment. Author (TAB)

N66-27903# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
MIGRATION AND CRYSTALLIZATION OF INTERLAMELLAR WATER DURING FREEZING AND THAWING OF WYOMING BENTONITE
Duwayne M. Anderson and Dieter Hoekstra Dec. 1965 24 p refs
(CRREL-RR-192; AD-631150) CFSTI: HC $2.60/MF $0.50

Homo-ionic, clay-water pastes of Wyoming bentonite were studied at near freezing temperatures by X-ray diffraction. On freezing, the initial high d (001) spacings of the lithium- and sodium-bentonite pastes decreased, first to about 19A and, at about −10°C, to 16Å. When the temperature was raised the d (001) spacings of the frozen clays increased substantially; on melting, the d (001) spacings quickly expanded to their initial high values. The behavior of the hydrogen-aluminum-, potassium-, and calcium-bentonite was similar except that spacings greater than about 20Å did not occur. Evidently, when bentonite-water pastes are frozen, all but two or three monomolecular layers of the interlamellar water migrate into the pore space to form ordinary ice. The remaining interlamellar water therefore must correspond to the unifrozen water of previous investigations. Only the diffraction peaks corresponding to the normal hexagonal ice structure were detected. The relative intensities of the diffraction peaks revealed evidence of epitaxy in that the ice crystals appeared to be preferentially oriented with their c-axes perpendicular to the c-axes of the clay crystals. Author (TAB)

N66-27944*# Geophysics Corp. of America, Bedford, Mass. Technology Div.
COMPEDIUM OF WIND DATA FROM THE VAPOR TRAIL TECHNIQUE
John F. Bedinger Mar. 1966 89 p
(Contract NASw-1083)
(NASA-CR-75649; GCA-66-7-N) CFSTI: HC $3.00/MF $0.75 CSCL 04A

Graphs are plotted for wind data in the earth's upper atmosphere at various localities throughout the world. Each wind observation, obtained by the vapor trail method, is presented in two separate graphs which display the wind speed and the direction of the transport vector. Location of the 13 launch sites as well as the place and date of the rocket launches are tabulated. M.W.R.

N66-27946*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
EXPERIMENTS ON EKMAN LAYER INSTABILITY
Peter R. Tatro Apr. 1966 95 p refs
(Grant NsG-496)
(NASA-CR-75606; CSR-T-66-2) CFSTI: HC $3.00/MF $0.75 CSCL 04A

Laboratory measurements were made of the instabilities of the Ekman layer using hot wire anemometers. The apparatus consisted of two parallel circular rotating plates forming a spool; the air was admitted through screens at the outer edge and removed through a screen cage at the hub. In the Ekman layers formed on the inner surfaces of the plates, measurements were made of the mean velocities as functions of r and z; the velocity fluctuations were also measured. The results show the changes in boundary layer profile with Reynolds number and Rossby number, and the critical Reynolds number for instability as a function of Rossby number. At higher Reynolds number another instability appears of shorter wavelength and slower speed; this instability is confined to the boundary layer. The phase speeds, frequencies and wave front orientations of both type instabilities have been measured. Author

N66-27955*# Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
INVESTIGATION OF WARM FOG PROPERTIES AND FOG MODIFICATION CONCEPTS Quarterly Progress Report, Period Ending 15 May 1966
Warren C. Kocmond [1966] 13 p refs
(Contract NASr-156; Proj. Fog Drops)
(NASA-CR-75518; CAL-RM-1788-P-12) CFSTI: HC $1.00/MF $0.50 CSCL 04A

An apparatus designed to test the theory that dense radiation fog can be prevented if extremely hygroscopic, large nuclei are introduced into the atmosphere before the fog begins to form, was constructed; and seeding experiments were conducted. A schematic diagram of the apparatus is depicted. Details of the experimental seeding technique are described. Visibility in both natural fog and seeded fog samples were measured. Results show that the seeded atmosphere produced fog in which visibility was 70% to 95% greater than the corresponding control fog. In addition, a note on calculations worked out for investigating the feasibility of promoting droplet coalescence in a fog by charging alternate adjacent regions positively and negatively is discussed. The calculations indicate that with small charges per droplet, no significant increase in mixing or mutual attraction between droplets can be expected. L.S.

N66-27960*# Northwestern Univ., Evanston, Ill. Dept. of Geography.
SOME COMMENTS ON CERTAIN TECHNICAL ASPECTS ON GEOGRAPHIC INFORMATION SYSTEMS Technical Report No. 2
Michael F. Dacey and Duane F. Marble Dec. 1965 16 p refs
Sponsored by NASA
(Contract Nonr-1228(35))
(NASA-CR-75576) CFSTI: HC $1.00/MF $0.50 CSCL 08F

This document is intended to serve as a general preface to subsequent project reports of a more technical and specialized nature. Special attention is directed toward the work being carried on in the areas of spatial statistics and two-dimensional languages, and the relevance of this work to the development of generalized geographic information systems. Author

N66-27974# Joint Publications Research Service, Washington, D. C.
GRAVIMETRIC SURVEYING
S. S. Krasovskiy 6 Jun. 1966 20 p Transl. into ENGLISH from the book "Metodika Kompleksirovaniya Geofizicheskikh Issledovaniy Pri Geologicheskom Kartirovanii" Kiev, Akad. Nauk Ukr. SSR, 1965 p 63–75
(JPRS-35845; TT-66-32279) CFSTI: $1.00

Problems related to the selection of an optimum network of gravimetric observations are considered, and the adjustment of gravimetric networks is discussed. The optimum reconnaissance interval for gravimetry is considered to be twice the interval used in magnetometry. While gravimetric surveying penetrates greater depths, its ability to separate anomalous effects caused by a group of exciting bodies is only half that of magnetometric surveying. M.W.R.

N66-27975# Joint Publications Research Service, Washington, D. C.
GEODETIC NETWORK CLASSIFICATION AND INTERPRETATION OF TOPOGRAPHIC SURVEYING
10 Jun. 1966 13 p Transl. into ENGLISH from Geod. i Kartografiya (Moscow), no. 4, Apr. 1962 p 70–71
(JPRS-35948; TT-66-32382) CFSTI: $1.00

Local and national geodetic networks in the Soviet Union are discussed, and instructions are given for topographic interpretation in stereotopographic surveying as well as for the revision of topographic maps. It is noted that the government geodetic network consists of triangulation, polygonal, trilateration, and leveling divisions; and general requirements for points on these networks are discussed. Continuous field, traverse field, and camera interpretations of aerial photography are considered. M.W.R.

N66-27977# Joint Publications Research Service, Washington, D. C.
SIXTH CONTINENTAL EXPEDITION 1960–1962: GENERAL DESCRIPTION AND PRELIMINARY SCIENTIFIC RESULTS
V. M. Driatskiy 8 Jun. 1966 51 p Transl. into ENGLISH from the publ. "Trudy Sovetskoy Antarkticheskoy Ekspeditsii" Leningrad, Hydrometeorol. Publishing House, v. 43, 1965 p 58-91
(JPRS-35903; TT-66-32337) CFSTI: $2.00

Scientific observations made by the 1960–1962 Soviet Antarctic expedition at the Mirnyy Observatory are reported in the following areas: terrestrial magnetism, auroras, cosmic rays, earth currents, seismic waves, and radio wave propagations. Medical investigations were made to study the acclimatization of man to Antarctic weather, with special emphasis on the nervous and cardiovascular systems. Subjective complaints were recorded more frequently during the middle of the winter (July) and more frequently by men over 40 years of age. For most of the mean, body weights increased and remained higher throughout the stay. General fatigue was evidenced in all the polar workers toward the end of the expedition, and tables summarize data relating to cardiac cerebral reflexes. A normal level of arterial pressure was observed for the majority of workers; and normal response reactions of the body were observed which did not exceed the limits of physiological adaptability. M.W.R.

N66-27984# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.
OCEAN SURFACE REVERBERATION: SURFACE INTERFACE SCATTERING

W. Abramowitz, A. Crews, and R. Erath May 1966 88 p refs (RE-252)

Basic mechanisms that could be responsible for the ocean surface reverberation that sometimes masks a submarine echo are studied. The portion of the program described herein involves an analytic and laboratory study of ocean surfaces and their effect in scattering the incident acoustic energy. The results of the study show that the shape of the ocean surface is not the dominant cause of reverberation that is found in the open ocean, and that some other scattering agent must be responsible. Further study of other scattering mechanisms is recommended. Author

N66-28028*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

PROBABILITIES OF ZERO WIND SHEAR PHENOMENA BASED ON RAWINSONDE DATA RECORDS

Lawrence E. Truppi 26 Apr. 1966 32 p refs Prepared jointly with Weather Bureau

(NASA Order H-66040)

(NASA-TM-X-53452) CFSTI: HC $2.00/MF $0.50 CSCL 04A

The term zero wind shear is defined for the condition where winds aloft attain speeds of 36 m/sec or higher and persist through a vertical distance such that there is maintained a vector wind shear in the interval ±5 m/sec per kilometer between successive 1-kilometer levels. Data are obtained from two RAWIN observations per day for five years from Santa Monica, California. Both data decks were edited, checked and serially completed before use. Results are presented as graphs of zero shear thickness versus peak wind speed, and as empirical probabilities of occurrence of zero wind shear conditions at altitudes above and below the mean height of the level of peak wind. Probabilities of total depth of zero wind shear are also presented. Author

N66-28070# Joint Publications Research Service, Washington, D. C.

SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 123

4 Jan. 1966 148 p refs

(JPRS-33573; TT-6111147-123) CFSTI: HC $4.00

News and abstracts of scientific articles are presented on the following topics: astronomy, meteorology, oceanography, terrestrial geophysics, and upper atmosphere and space research. N.E.N.

N66-28082# Joint Publications Research Service, Washington, D. C.

AFTERSHOCK MECHANISM AND THE INELASTIC PROPERTIES OF THE EARHT'S CRUST

K. V. Pshennikov 6 Jun. 1966 96 p Transl. into ENGLISH from the book "Mekhanizm Vozniknoveniya Aftershokov i Neuprugiye Svoystva Zemnoy Kory" Moscow, 1965 p 3-81

(JPRS-35846; TT-66-32280) CFSTI: HC $3.00

Existing data and prevalent hypotheses concerning the nature of strong earthquake aftershock process are discussed. An attempt was made to clarify the general course of this process in order to determine its nature; and the inelastic properties of the crust were investigated on the basis of the existing observational data. In conclusion it is noted that the possibility of the formation of an inelastic, i.e., plastic, zone at the earthquake focus has been admitted. It is shown that the hypothesis of viscoelasticity decrease of the medium at the focus of a strong earthquake agrees with existing concepts on the processes at the focus, and also with the behavior of materials under high pressure. The application of this hypothesis to the aftershock process leads to an explanation of its observed behavior. D.T.

N66-28090# Oslo Univ., Blindern (Norway). Norwegian Inst. of Cosmic Physics.

STATISTICS CONCERNING THE APPEARANCE OF ENHANCED VLF-EMISSIONS ON 8 kc/s OBSERVED NEAR THE AURORAL ZONE OVER A TWO-YEAR PERIOD

Leif Harang 1 Oct. 1965 19 p refs *Its* Sci. Rept.-3

(Contract AF 61(052)-811)

(AFCRL-66-10; AD-628748) CFSTI: HC $1.60/MF $0.50

The results of a two-year period, June 1963–June 1965, of VLF-emission recordings on 8 kc/s at the Auroral Observatory at Tromso, near the northern auroral zone, is given. The annual curve of appearance of the bursts shows a pronounced variation with a maximum during winter time and a minimum during summer time. In the months November–February VLF-emissions are likely to appear daily for a period of about 1 hour. The diurnal curve shows that the VLF-emissions are limited to appear within the six hours interval 18–24 MET. The character of the annual and diurnal curves is explained as due to absorption within the lower part of the ionosphere; the annual absorption effect as due to solar control of the absorption process, the diurnal absorption effect is controlled mainly by the ionospheric absorption due to geomagnetic and auroral disturbances and the after effects of these. Author (TAB)

N66-28144# Institut Royal Meteorologique de Belgique, Brussels.

ON THE THERMODYNAMIC EQUIVALENT TEMPERATURE [SUR LA TEMPERATURE THERMODYNAMIQUE EQUIVALENTE]

L. Dufour 1965 29 p refs In FRENCH *Its* Publ. Ser. B, no. 46

CFSTI: HC $2.00/MF $0.50

The concept of equivalent temperature is discussed; and the various sets of atmospheric conditions under which thermodynamic equivalence may take place are described. It is shown that there are as many equivalent temperatures as there are supposed processes for the condensation of humid air water vapor isobarically and adiabatically or pseudoadiabatically. Particular definitions of thermodynamic equivalence are derived for each of the sets of atmospheric conditions. Transl. by D.T.

N66-28147# Finnish Meteorological Office, Helsinki.

MAGNETIC RESULTS FROM NURMIJAERVI GEOPHYSICAL OBSERVATORY, 1964

10 May 1965 32 p ref

(Rept.-6) CFSTI: HC $2.00/MF $0.50

Absolute measurements were made with QHM_{84}, QHM_{85}, QHM_{86}, QHM_{286}, QHM_{287}, BMZ_{25} and BMZ_{108} for H and V and with two Askania–Reisetheodolites for D. Absolute measurements of F were taken with a proton magnetometer; this value and H were used for the base line value of V. The measurements were taken three times a month on the average. The QHMs and BMZs were compared at the Nurmijarvi Observatory with the Danish standards in June 1964. In these comparisons the shift of the constants of the QHMs was found to be less than 1 γ per year and the shift of the constants of the BMZs was 2 and 3 γ per year. The Rude Skov values for H and V gave the same value for F as the proton magnetometer. Author

N66-28183# Finnish Meteorological Office, Helsinki.
OBSERVATIONS OF RADIOACTIVITY FOR THE YEAR 1964, NO. 4
1965 68 p ref
CFSTI: HC $3.00/MF $0.50

Fractions of aerosol beta activity decaying within four hours and those which remain for three days after the end of a four-hour sampling period are presented in hourly charts for 1964. Measurements were made at various stations in Finland of radioisotopes found in air and rain water, and data are also included for beta activity in precipitation and settled dust measured at two stations. Measurements were made by drawing air through two filter cylinders, and the count rate of beta-active matter gathered outside the cylinders was registered continuously by two Geiger-Mueller counters mounted coaxially inside the filters. Hourly values were punched on cards; and data were computed by an IBM 1401, with corrections made for fluctuations in the air flow. M.W.R.

N66-28206# National Physical Lab., New Delhi (India). Radio Propagation Unit.
SOLAR AND GEOPHYSICAL DATA, PART 2
Feb. 1966 17 p
(RRC-A128, Pt. 2) CFSTI: HC $1.00/MF $0.50

Solar and geophysical data, recorded during January 1966, at the astrophysical observatory at Kodaikanal and at the radio propagation unit of the National Physical Laboratory in Delhi are presented. Tabulated data listed are: (1) geographical and geomagnetic latitudes and longitudes for the participating stations, (2) solar indices predicted sunspot numbers, (3) observed sunspot numbers, (4) optical observations of solar flares, (4) outstanding occurrences of solar radio emissions, (5) magnetic storms, and (6) ionospheric effects of solar flares, (on frequency, noise absorption and fadeout, phase anomalies, and signal and atmospheric enhacements). Chart recordings of radio signal data are depicted. L.S.

N66-28224# Genoa Univ. (Italy). Inst. of Geophysics and Geodetics.
GENOA-MONTE CAPELLINO OBSERVATORY. IONOSPHERIC DATA, JANUARY-DECEMBER, 1965 (IQSY)
[1966] 71 p
CFSTI: HC $3.00/MF $0.75

Ionospheric sounding data derived from film records made at the Monte Capellino Observatory at the University of Genoa are presented for each month of the year 1965. Geographic and geomagnetic latitudes of the Observatory are 44°33'05" N and −45°8 respectively. Geographic and geomagnetic longitudes of the Observatory are 8°57'29"E and 89°.5 respectively. The observatory is 640 m above sea level; magnetic dip is −60°.5; and GMT time was used. Vertical soundings were measured by equipment of the Freiburg type. Sweep was 1-20 Mc/s in 3 minutes; height and frequency markers were crystal controlled; delta and rhombic aerials were used for both transmitting and receiving; and the records were taken on 35 mm film. Routine soundings were made every hour. In addition to the panoramic hourly soundings, continuous records of the main ionospheric characteristics were made. Routine vertical incidence absorption measurements were also made by means of the pulse reflection method. This equipment was also of the Freiburg type. Frequency was 2 Mc/s; peak pulse power was about 3 Kw; rhombic aerials were used; and records were taken on 16 mm film. A list of symbols and abbreviations used for the listed data is given. L.S.

N66-28275# Geological Survey, Denver, Colo.
A PRELIMINARY SUMMARY OF THE SEISMIC-REFRACTION SURVEY IN THE VICINITY OF THE CUMBERLAND PLATEAU OBSERVATORY, TENNESSEE Technical Letter No. 43
Roger D. Borcherdt and John C. Roller 21 Feb. 1966 34 p refs
(ARPA Order 193-65)
(AD-631437) CFSTI: HC $2.00/MF $0.50

A seismic-refraction survey was conducted in the vicinity of the Cumberland Plateau Observatory, Tennessee, (C.P.O.) in June and July 1965, to determine the velocities of seismic waves in the crust and upper mantle and the crustal structure. A total of 1300 km of reversed seismic-refraction coverage was obtained along two profiles which intersect at the observatory. Each profile is approximately 400 km in length. The velocity of seismic waves is 6.1 km/sec P_g in the upper crustal layer, 6.7 km/sec (P^*) in the intermediate layer, and 8.0 km/sec P_n or slightly higher in the upper mantle. The depth to the intermediate layer varies from 6.3 km to 14.5 km. The Mohorovicic discontinuity dips toward the south from depths of 35 km in southern Kentucky near Fort Campbell, and Burnside, to depths of 45 km near Gainesville, Georgia, and 51 km near Moulton, Alabama. The preferred crustal model at C.P.O. is: H_1=12 km, V_1=6.1 km/sec, H_2=28 km, V_2=6.7 km/sec for a total crustal thickness of 40 km, with an upper-mantle velocity of 8.0+km/sec.
Author (TAB)

N66-28282# Naval Research Lab., Washington, D. C.
ANALYSIS OF ELECTRON CONTENT ERRORS INTRODUCED THROUGH USE OF A SIMPLIFIED FARADAY ROTATION TECHNIQUE
John M. Goodman Feb. 1966 21 p refs
(NRL-Memo-1684; AD-631227) CFSTI: HC $1.00/MF $0.50

Faraday rotation has proven to be an exceedingly useful tool in the study of the ionosphere. The amount of rotation of the electric vector of a linearly polarized radio wave is directly proportional to the number of free electrons along the propagation path. Unfortunately the rotation angle at radar frequencies of interest is typically ambiguous. That is to say, the amount of rotation usually exceeds 180°. The rotational ambiguity may be avoided by making certain simplifying assumptions. The ultimate accuracy of the electron content measurements is obviously dependent upon the truthfulness of the assumptions which are embodied in the simplifications. In actuality only one assumption must be made—that of total electron content invariance over a given period of time. This assumption requires that the ionospheric structure be uniform in space and a constant function of time. It also requires that the target be superionospheric. The degree of error introduced by these constraints is the subject of this note. The discussion is specifically directed toward the problem of deducing the columnar electron content between the Randle Cliff radar site and Echo II (1964-4A) satellite. Nevertheless, in principle, the Faraday error analysis may be applied to any satellites. Author (TAB)

N66-28293# Lincoln Lab., Mass. Inst. of Tech., Lexington.
CAPABILITIES OF THE EXPERIMENTAL LARGE APERTURE SEISMIC ARRAY Interim Report
Howard W. Briscoe, Jack Capon, Philip L. Fleck, Jr., Paul E. Green, Jr., Roy J. Greenfield et al 24 Feb. 1966 41 p /tb Tech. Note 1966-16
(Contract AF 19(628)-5167; ARPA Order 512)
(ESD-TDR-66-47; AD-631285) CFSTI: HC $3.60/MF $0.50

This report presents an interim appraisal of capabilities of a single Large Aperture Seismic Array system to perform the following functions: (1) preprocess arriving seismic signals to increase their detectability, (2) use such preprocessed signals to perform on-line automatic detection and location, (3) process recordings of LASA data off-line, and (4) use the results of the off-line processing for studies of seismic source type. Author (TAB)

N66-28305# Applied Physics Lab., Johns Hopkins Univ., Silver Spring Md.

CONFERENCE ON THE EARTH'S ALBEDO NEUTRON FLUX, 15-16 OCTOBER 1963

D. J. Williams and C. O. Bastrom, comp. 16 Oct. 1963 221 p refs

(Contract NOw-62-0604-c)

(TG-543; AD-631801) CFSTI: HC $6.00/MF $1.25

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N66-28366*# National Aeronautics and Space Administration, Washington, D. C.

REGULARITIES IN COMPOSITION AND STRUCTURE OF METEORITES AND PROBLEM OF THEIR ORIGIN [ZAKONOMERNOSTI V SOSTRAVE I STROYENII METEORITOV I PROBLEMA IKH PROISKHOZHDENIYA]

A. A. Yavnel' May 1966 21 p refs Transl. into ENGLISH from Meteoritika (Moscow), no. 26, 1965 p 26-34

(NASA-TT-F-10128) CFSTI: HC $1.00/MF $0.50 CSCL 03B

A classification of meteorites by composition into four groups, based on their gallium-germanium content, is suggested for a determination of their origin. Plotted data on the correlation of the structure of iron meteorites with their nickel, gallium, and germanium content demonstrate that fractionation of the meteorite matter took place at an early stage of formation and that the phase transistions in the various groups proceeded at different rates, indicating a different rate of cooling. Width of the kamacite grain, nickel content, and magnetic properties showed distinct regularities in the different groups. An extrapolation to the parent asteroids indicates varying size and structure of these bodies. Author

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N66-28925# Michigan Univ., Ann Arbor. Dept. of Nuclear Engineering.

AMPLITUDE DETERMINATION OF AN ULTRASONIC TRANSDUCER BY MEANS OF AN ACCELEROMETER ASSEMBLY

R. Garcia and F. G. Hammitt Dec. 1965 31 p refs

(Grant NSF G-22529)

(Rept.-05031-7-I)

An accurate method for measuring the amplitude of vibration at the tip of an ultrasonic transducer assembly used for cavitation experiments has been developed. The method consists of monitoring the voltage output from a suitable accelerometer which is mounted at the top of the vertical transducer assembly where it is readily accessible and not subject to the severe experimental environment that may exist in the vicinity of the test specimen which is attached to the lower end. A calibration of absolute amplitude at the horn tip versus the voltage output from the accelerometer makes it possible to determine the desired amplitude under any test conditions. The accelerometer is capable of operation at frequencies up to approximately 20 Kc/sec and can measure amplitudes in the range 0-3 mils with an accuracy of ±0.1 mils. Author

N66-28936# Data Corp., Dayton, Ohio.

IMAGE ASSESSMENT RESEARCH Final Report

J. D. Finley and W. W. Marshall [1965] 246 p refs

Reproducible and reliable methods of photographic image assessment were investigated to evaluate reconnaissance system performance. Emphasis was placed upon a Fourier type analysis of edges appearing in photographs, because these appear profusely in normal photography and do not require any geometric or dimensional information. However, it is noted, the spatial frequency structure of edges is such that measurement signal energy diminishes inversely as the square of spatial frequency. This creates no problem in noise free measurements; but photographs are characterized by grain structure, the existence of which produces uncertainty in measurement. It was found that edge traces are at best only statistical estimates of system performance. To improve this estimate multiple trace procedures must be used, along with some method of optimal filtering based on the statistical properties of both the signal and the noise. The edge analysis technique is satisfactory for image assessment purposes only, and does not lend itself to diagnostic work and the estimation or errors in system parameters. D.T.

N66-28963# Joint Publications Research Service, Washington, D. C.

A HOT-WIRE WIND TUNNEL TURBULENCE SPECTRAL ANALYZER

Chen-hua Ma and Hui-yun Li *In its* Transl. on Communist China's Sci. and Technol. 17 Mar. 1966 p 1–9 refs Transl. into ENGLISH from Ch'i-hsiang Hsueh-pao (Peking), v. 35, no. 4, Nov. 1965 p 434–438 (See N66-26962 15-15) CFSTI: $3.00

Based on the theory of spectral analysis for pulsating air flow, a hot-wire turbulence spectral analyzer for the direct measurement of pulsating spectral density of air flow in wind tunnel was made. This paper describes the theory, detail structure and salient parameters of the instrument. Some experimental data are also reported. Author

N66-27046*# Farrand Optical Co., Inc., New York.
VIRTUAL IMAGE OUT-THE-WINDOW DISPLAY SYSTEM STUDY, VOLUME I
Matthew Baum, Raymond Bull, Joseph La Russa, Lester Mayer, and Martin Shenker Jan. 1966 386 p
(Contract NAS9-3678)
(NASA-CR-65367) CFSTI: HC $7.00/MF $2.00 CSCL 20F

A study of virtual image out-the-window display systems has been completed. A variety of configurations has been analyzed and three basic forms were selected as representative variations of the infinity image system. Each of these three characteristic designs was studied to determine its applicability to the parameters and characteristics defined by the statement of work. The recommended design is shown to emerge from a thorough consideration of the trade-offs and compromises necessary to achieve the desired characteristics. A design specification is included as a part of this report. In addition to recommendations for a display system, the study explores a variety of possibilities for the input or image generation end of the simulation system. Particular attention is paid to high resolution TV techniques, which together with several other methods of image generation are exhaustively examined with an eye towards expected future capabilities. Author

N66-27065*# General Electric Co., Johnson City, N. Y.
OPTICAL-INERTIA SPACE SEXTANT FOR AN ADVANCED SPACE NAVIGATION SYSTEM, PHASE B
W. D. Foley, G. F. Auclair, J. J. Wilczynski, and R. M. Derby Washington, NASA, Jun. 1966 126 p refs
(Contract NAS2-1087)
(NASA-CR-498) CFSTI: HC $4.00/MF $1.00 CSCL 17G

Work performed in Phase B of a program to develop an optical-inertial space sextant for an advanced space navigation system is reported. Efforts accomplished on the optics, television camera, and data processing are described along with systems considerations and test results. A laboratory model of an off-axis space sextant tracker system was designed, fabricated, and tested. The system successfully demonstrated its ability to locate single stars within the field of view, determine the interangular separation between multiple stars, detect actual stars with the narrow and intermediate mode optics down to 2.2 visual magnitude with a minimum peak signal to rms noise ratio of 10/1, detect extended bodies in both orthogonal and radial scan modes, detect disc edges in orthogonal scan, and operate with slewing rates ranging from 0.15°/min for narrow mode optics to 13.1°/min for wide mode optics. R.N.A.

N66-27124# Rocky Flats Div., Dow Chemical Co., Golden, Colo.
THE ROCKY FLATS BODY COUNTER
V. P. Johnson 12 Nov. 1965 14 p refs
(Contract AT(29-1)-1106)
(RFP-462) CFSTI: HC $1.00/MF $0.50

A body counting facility was completed for the detection of plutonium and uranium in humans. The facility includes two showers, a steel shield 8 by 9 feet high inside, and a crystal spectrometer. Author (NSA)

N66-27162# California Univ., Livermore. Lawrence Radiation Lab.
SYSTEM FOR MONITORING PULSE VOLTAGES ON MAGNETIC CORES IN THE ASTRON ACCELERATOR
L. L. Steinmetz *In its* Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res. [1965] p 105–108 (See N66-27146 15-25) CFSTI: HC $6.00/MF $1.25

Because of the large size and complexity of the system (74,000 components, plus 1 million feet of RG cable), effective operation of the Astron gun and accelerator depends heavily upon electronic monitoring. A system is described which simultaneously monitors 333 magnetic core pulses (12 to 16 kV at 0.4 μsec duration) in a parallel-to-serial operation. The monitor system has two modes of operation: (1) to determine whether the core pulses are within ±5% (or ±10%) of the normal pulse in integrated area, or (2) to determine which of the 423 thyratron modulators may be prefiring. This system is used to detect component failure and modulator timing drift and can be operated by one electronics technician. Author

N66-27164# Princeton Univ., N. J. Plasma Physics Lab.
A FERROMAGNETIC RESONANCE MAGNETOMETER
W. P. Ernst and A. H. Skislak *In* Calif. Univ. Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res. [1965] p 112–116 refs (See N66-27146 15-25) CFSTI: HC $6.00/MF $1.25
(Contract AT(30-1)-1238)

A ferromagnetic resonance magnetometer using an yttrium iron garnet (YIG) sphere appropriately mounted in a waveguide has been developed for use in plasma experimentation involving electron cyclotron resonance phenomena. The twofold purpose of the system is to (1) measure the plasma-confining field to 1 part in 10^4, and (2) provide a magnetic-field dependent output signal for precise control of the time of plasma discharge initiation. Use of a YIG with its fixed gyromagnetic ratio converts the problem of precise measurement of a magnetic field into the problem of precise measurement of a frequency. Magnetic fields of the order of 12 kG require a system frequency in the 35,000-Mc range to observe the ferromagnetic resonance of the YIG. The frequency measuring scheme employing an improved transfer oscillator type of system, the development and calibration of the YIG device, and the remote control features of the system are described. Author

N66-27165# Oak Ridge National Lab., Tenn.
DCX-2 SCANNING ENERGY SPECTROMETER
J. S. Culver *In* Calif. Univ. Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res. [1965] p 123–127 (See N66-27146 15-25) CFSTI: HC $6.00/MF $1.25

A scanning energy spectrometer used for DCX-2 diagnostic probes is described. The sensing element of the spectrometer is a silicon barrier semiconductor detector whose pulse amplitude is proportional to the energy of the incident particles. The neutral particles falling on the detector are collimated to admit a fan-shaped beam about 0.1° thick and 60–90° high. Designed to scan through an angle of ±30° in either a vertical or horizontal plane, with a readout accuracy of about 1°, the device can be used to examine the energy spectrum of a representative cross section of the trapped plasma. The output signal is normally fed to a single-channel pulse height

analyzer and a linear count-rate meter whose output can be displayed on an X-Y recorder as a function of angular position. The many degrees of freedom provided by this device plus the many possible ways in which the signal may be handled provide a picture of both the plasma geometry and the energy distribution of the charged particles. Author

N66-27231*# Geophysics Corp. of America, Bedford, Mass. Technology Div.
DEVELOPMENT OF A MASS SPECTROMETER EMPLOYING A PHOTOIONIZATION SOURCE
W. P. Poschenrieder and A. R. Barrington Feb. 1966 67 p refs
(Contract NAS1-4927)
(NASA-CR-66100; GCA-TR-66-3-N) CFSTI: HC $3.00/MF $0.75 CSCL 20F

This report describes the construction of a mass spectrometer that uses photoionization for ion production instead of the conventional electron impact ion source. An ultraviolet vacuum monochromator is used to select the proper wavelength which results in simplified spectra. This method suppresses the fragmentation of molecules, excludes chemical reactions with hot filaments, and eliminates outgassing from heated elements all of which occur in electron impact ion sources. The method can also differentiate gases which peak at the same mass number, such as N_2 and CO, and can select the energy of the ionizing photons with a precision unsurpassed by any other method of ionization. The only limitation lies in the monochromator which, at present, can detect 100 ppm of CH_4 in a pure O_2 atmosphere and 0.5% of CO in an N_2 atmosphere. It is believed that some monochromator alterations can be made to improve the detection of CO in N_2. R.N.A.

N66-27237*# Research Triangle Inst., Durham, N. C.
A FEASIBILITY STUDY OF A THIN FILM OXYGEN PARTIAL PRESSURE SENSOR Final Report, 8 Dec. 1964-7 Jan. 1966
J. J. Wortman [1966] 110 p refs
(Contract NAS1-4617; RTI Proj. EU-200)
(NASA-CR-66084) CFSTI: HC $4.00/MF $0.75 CSCL 14B

This study was conducted to determine the feasibility of using thin film devices as oxygen partial pressure sensors in the 0 to 300 mm Hg pressure range, and to determine the advantages and disadvantages of thin film sensors over conventional designs. The three thin film techniques studied were the galvano-diffusion effect, conductance modulation, and controlled oxidation. The conductance modulation method, using thin film gold, was found to be the most promising. R.N.A.

N66-27239*# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
SLUSH HYDROGEN INSTRUMENTATION STUDY Final Report, 1 Mar. 1964-1 Mar. 1966
W. J. Alspach, T. M. Flynn, and R. J. Richards 1 Mar. 1966 211 p refs
(NASA Order CC-14032; NBS Proj. 31506-12-3150461)
(NASA-CR-75314; NBS-8879) CFSTI: HC $6.00/MF $1.25 CSCL 14B

Means of determining the fraction solids (quality) of a mixture of solid and liquid hydrogen at the triple point were investigated. Attention was also given to the feasibility of a slush hydrogen mass flowmeter development program, and the application of conventional liquid level sensors to this system. It was determined that: (1) solid–liquid quality meters are available for some applications having a precision of approximately ±2 percent, (2) several mass flowmeter principles could be developed for this system provided that adequate flow stands existed for the testing, proving, and developing of these meters, and (3) several conventional liquid level sensors are available which can detect one or more of the interfaces present in this solid–liquid–vapor hydrogen system. Author

N66-27250# Los Alamos Scientific Lab., N. Mex.
A DOSE MONITORING INSTRUMENT FOR NEUTRONS FROM THERMAL TO 100 MEV
Stephen A. Mc Guire 1 Mar. 1966 25 p refs
(Contract W-7405-ENG-36)
(LA-3435) CFSTI: HC $2.00/MF $0.50

A proposed neutron monitoring instrument consists of a Li^6I crystal centered in 3-in.-, 10-in.-, and 18-in.-diameter polyethylene spheres. The polyethylene moderates neutrons so that they may be counted as the result of the (n,α) reaction in the crystal. Transport-theory calculations of sphere counting efficiencies use 21-group cross sections from thermal energies to 192 Mev. The monitoring system is found effective for particle accelerators where neutrons up to 100 Mev in energy would be found. Author (NSA)

N66-27374# Kernforschungsanlage, Juelich (West Germany). Institut für Neutronenphysik.
A HIGH-RESOLUTION SPECTROMETER FOR VERY SLOW NEUTRONS FOR USE ON COLD SOURCES OF A VERY HIGH FLUX REACTOR [EIN HOCHAUFLOSENDES SPEKTROMETER FUR SEHR LANGSAME NEUTRONEN ZUR VERWENDUNG AN DER KALTEN QUELLE EINES HOCHSTFLUSSREAKTORS]
R. Scherm Aug. 1965 24 p refs In GERMAN
(JUL-295-NP)

A spectrometer designed for neutrons with wavelengths of 4 to 25 Å is described. The energy resolution of the spectrometer is between 0.4 and 5.0%. NSA

N66-27375# Kernforschungsanlage, Juelich (West Germany). Institut für Reaktorbauelemente.
GAMMA SPECTROMETRY WITH SEMICONDUCTOR DETECTORS [GAMMA-SPEKTROMETRIE MIT HALBLEITERDETEKTOREN]
G. Riepe and H. Petri Oct. 1965 16 p refs In GERMAN
(JUL-308-RB)

Two semiconductor counters, Ge(Li) and Si(Li), prepared by the Li-drift method, were compared with an NaI(Tl) scintillation counter in a multichannel spectrometer. The results showed that the Ge(Li) counter is superior to the NaI scintillation counter with respect to resolution, but the reverse is true with respect to the γ yield. The rise-time constant for the pulse in the Ge(Li) counter is about 30 nsec, almost 10 times smaller than in a NaI scintillation counter. NSA

N66-27412# Edgerton, Germeshausen and Grier, Inc., Santa Barbara, Calif.
DEVELOPMENT OF AIRBORNE SURVEILLANCE INSTRUMENTATION
John E. Hand and Harold A. Lamonds Feb. 1966 180 p refs
(Contract DA-49-146-XZ-250)
(S-283-R; DASA-1704; AD-630868) CFSTI: HC $17.60/MF $1.00

A gamma ray detector was constructed using an inorganic scintillator, CsI (Tl), that is viewed by three photomultiplier (PM) tubes. The phosphor is encased in a plastic fluor so that the PM tube array also detects scintillations in the fluor. The detector forms a phoswich assembly (Rev. Sci. Inst. 23:414–417 (1952)), permitting pulse shape discrimination

against charged particle reactions occurring within it. External circuitry rejects single signals from the fluor, and fluor/phosphor coincident signals. The unit approaches 100% rejection effectiveness in preventing charged-particle reactions in the detector from introducing signals into the measurement circuitry. Gamma ray losses resulting from gamma–fluor reactions are less than 9% of the total recorded gamma activity in the main CsI (Tl) detector for energies below 1.4 Mev. The detector incorporates a small inset-well crystal lying on the central axis, that is optically separated from the CsI; the ratio of inset-well count rate to main crystal count rate provides a directionality parameter defining source position with respect to crystal axis. The detector shows an energy response linearity within the limitations of the analyzer used in the measurements, ±1/2%. The resolution for Cs-137 gamma rays exhibited by the assembly is 15.4%. Gamma ray spectral data can be collected with the charged particle rejection feature in operation. Author (TAB)

N66-27420# Battelle Memorial Inst., Columbus, Ohio.
INVESTIGATION OF THE OCCURRENCE OF CONDENSATION IN FLIGHT INSTRUMENTS Technical Report, Sep. 1963–Dec. 1965
Benson G. Brand, Bailey Bennett, and Robert I. Leininger Wright-Patterson AFB, Ohio, Systems Eng. Group, Jan. 1966 59 p
(Contract AF 33(657)-12462)
(SEG-TR-66-2; AD-630664) CFSTI: HC $5.60/MF $0.75

This study is related to the location and identification of sources of fog formation on the faceplates of hermetically sealed aeronautical instruments. Two types of fog (moisture and permanent) were found. Moisture fog was shown to be caused by imperfect hermetic sealing of the instrument cases. Permanent (oily) fog was found to be the result of partial decomposition of nonmetallic materials by heat. This decomposition in certain materials results in oily products with appreciable vapor pressure, which may condense on the instrument faceplate, usually the coolest part of the instrument. Thirteen aeronautical instruments representing seven different types, and made by five different suppliers, were covered by this study. Included in the Report are: (1) A list of recommended materials; (2) a list of materials shown to contribute to permanent-fog formation; (3) a discussion of the psychrometry of gases; (4) a discussion of desiccants; (5) a critique of the ice-cube test; (6) a recommended modification of the ice-cube test to duplicate more nearly the use conditions; (7) a description of a high-sensitivity fog-potential test; (8) instructions for the use of the test in Item (7); and (9) pertinent exerpts from the International Critical Tables. Author (TAB)

N66-27428# Naval Radiological Defense Lab., San Francisco, Calif.
PHOTON, NEUTRON AND CHARGED PARTICLE ABSORBED DOSE MEASUREMENTS WITH A PORTABLE MICROCALORIMETER
Norman Goldstein, Eugene R. Schleiger, and Eugene Tochilin 14 Apr. 1966 26 p refs
(USNRDL-TR-976; AD-630693) CFSTI: HC $2.00/MF $0.50

Two compact, portable microcalorimeters were built and used to measure absorbed dose. A thermal shield near liquid nitrogen temperature provides the necessary isothermal environment for the absorber. Temperature increase of the absorber during irradiation is measured with a thermistor. Tissue equivalent plastic and beryllium absorbers were calibrated for absorbed energy as a function of temperature change by exposures to standard Co^{60} and Cs^{137} gamma-ray sources. The beryllium absorber detected gamma-ray doses as low as 0.17 rads (17 ergs/g) with a standard error of 6 percent. Microcalorimetric measurements of absorbed dose from continuous and pulsed X-rays, reactor neutrons, and charged particles were compared to measurements with other dosimeter systems. Author (TAB)

N66-27441# Navy Dept., Washington, D. C.
AN ABYSSAL AUTOMATIC TURBULENCE METER, AN INSTRUMENT FOR THE REGISTRATION OF TURBULENT FLUCTUATIONS OF VELOCITY AND TEMPERATURE IN THE OCEAN
A. A. Kolesnikov, N. A. Panteleyev, V. D. Pisarev, and P. V. Vakulov [1966] 14 p Transl. into ENGLISH from Okeanologiya (Moscow), no. 5, 1963 p 911–921 *Its* Transl. No. 985 (TT-66-60931; AD-630741) CFSTI: HC $1.00/MF $0.50

The abyssal, self-contained turbulence meter is a cylindrical steel container which is placed vertically, and which contains a special frame to which the sensors are fastened. The container is equipped with a stabilizer for setting the entire instrument according to the current. Author (TAB)

N66-27444# Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
PROJECT AMPIRT SECOND TEST PERIOD REPORT Special Interim Report No. 3
John E. Walker and George H. Snider Aug. 1965 38 p refs *Its* Interim Tech. Rept.-1
(Contracts AF 30(602)-3541; AF 33(657)-13172)
(CAL-VE-2027-D-3; CAL-VE-1931-D-3; AD-630882) CFSTI: HC $2.00/MF $0.50

This report presents a chronological summary of the conduct of the photographic tests on the second field trip to Thailand, 1 June 1965 through 10 July 1965. Of the 479 rolls of 70 mm film which were planned to be exposed, 352 rolls of imagery were obtained for analysis. Author (TAB)

N66-27450# Rocky Flats Div., Dow Chemical Co., Golden, Colo.
A PRECISION BACK-REFLECTION LAUE CAMERA
A. W. Brewer and R. R. Mc Donald 19 Jan. 1966 7 p
(Contract AT(29-1)-1106)
(RFP-636) CFSTI: HC $1.00/MF $0.50

A precision back-reflection Laue camera is described, which utilizes an optical attachment and micrometer stage to align precisely a small area of specimen to the X-ray beam. The beam can be confined to one particular crystal grain or an isolated single crystal as small as 0.5 mm in diameter. The need for such accurate alignment is generated by grain perfection and orientation studies on relatively small-grained polycrystalline specimens. Author (NSA)

N66-27451# Rocky Flats Div., Dow Chemical Co., Golden, Colo.
IMPROVED ELECTRODELESS TOROIDAL CONDUCTIVITY ANALYZER
C. M. Johnson and G. E. Hart 11 Feb. 1966 17 p refs
(Contract AT(29-1)-1106)
(RFP-657) CFSTI: HC $1.00/MF $0.50

An improved electrodeless toroidal conductivity analyzer was designed and constructed. Improvements in the instrument sensitivity were achieved by frequency tuning, modified toroidal configuration, and increased core mass. Improvements in instrument design were achieved by transistorized circuitry, including automatic temperature compensation. Author (NSA)

N66-27453# Rocky Flats Div., Dow Chemical Co., Golden, Colo.

A LARGE AREA GAS PROPORTIONAL DETECTOR FOR LOW ENERGY PHOTONS

W. H. Tyree 6 Jan. 1966 16 p refs

(Contract AT(29-1)-1106)

(RFP-637) CFSTI: HC $1.00/MF $0.50

A large-area gas proportional detector developed for use in a whole-body counter is described. The photons associated with the alpha decay of ^{239}Pu are detected. A comparison of the sensitivity of the gas proportional detector and of an NaI(Tl) thin-crystal detector is included. NSA

N66-27456# Rocky Flats Div., Dow Chemical Co., Golden, Colo.

AN AUTOMATIC RECORDING, LOW-TEMPERATURE DILATOMETER

R. R. Mc Donald and R. J. Pinkney 1 Feb. 1966 7 p

(Contract AT(29-1)-1106)

(RFP-868) CFSTI: HC $1.00/MF $0.50

A dilatometer, having the temperature range of 50 to 500°K, is described. Temperature is recorded directly in millivolts on the X axis of a direct-reading, X-Y, fixed-chart recorder while the change in length is simultaneously recorded on the Y axis. The result is a complete graph of the temperature and dilatation, which needs only the translation of the recorded voltage readings to useful values of length and temperature. Control of the cooling cycle can be easily maintained at any rate (within desirable limits) between 0.5 and 100°K/min. Similar control of the heating cycle can be attained by conventional Variac control of the furnace element. NSA

N66-27459# Rocky Flats Div., Dow Chemical Co., Golden, Colo.

THIN FILM EVAPORATION RATE MONITOR

T. Van Vorous, G. E. Hart, J. L. Martinez, and R. L. Beno 17 Feb. 1966 21 p

(Contract AT(29-1)-1106)

(RFP-602) CFSTI: HC $2.00/MF $0.50

A device is described with which the rate of evaporation of metals can be monitored and the final thickness deposited upon a substrate can be measured. NSA

N66-27482# Aeroprojects, Inc., West Chester, Pa.

APPLICATIONS OF ULTRASONIC ENERGY: ULTRASONIC INSTRUMENTATION FOR NUCLEAR APPLICATIONS Biomonthly Progress Report No. 28, Dec. 1, 1965–Jan. 31, 1966

Feb. 1966 13 p

(Contract AT(30-1)-3822)

(NYO-3622-1) CFSTI: HC $1.00/MF $0.50

Ultrasonic instrumentation for the detection of incipient boiling in molten metal is discussed. Preliminary designs for feasibility testing of an acoustic flowmeter are discussed. The method for making preliminary measurements under conditions approximating end-use is outlined. NSA

N66-27532*# Brown Engineering Co., Inc., Huntsville, Ala. Research Labs.

A FEASIBILITY STUDY OF AN ADVANCED SPACE ENVIRONMENTAL EFFECTS SENSOR

W. L. Chisholm, J. E. Scalf, and R. W. Blanton, Jr. Mar. 1966 56 p refs

(Contract NAS8-20166)

(NASA-CR-75398; TR-192) CFSTI: HC $3.00/MF $0.50 CSCL 14B

This report summarizes the results of a feasibility study of an Advanced Space Environmental Effects Sensor (ASEES) using active control of sensor temperature. A detailed thermal analysis is presented followed by conceptual designs of three possible systems, two using active heating and a third using a thermoelectric module for active cooling/heating. Guidelines for a stability and error analysis are included as well as recommendations for further studies. Author

N66-27542*# Lockheed Electronics Co., Edison, N. J. Industrial Technology Div.

ENDLESS LOOP MAGNETIC TAPE RECORDER Final Report

Feb. 1966 66 p

(Contract NAS5-3914)

(NASA-CR-75410) CFSTI: HC $2.00/MF $0.75 CSCL 14C

This program was conducted to design, develop, fabricate, test, and deliver a 1000 foot compact endless loop magnetic recorder which uses 1/2 inch wide tape. The tape contains five tracks with associated head parameters to enable recording and reproducing a signal at a frequency range of from 20 to 130 kc. Record and reproduce is performed at a tape speed of 33 ips. Included are descriptions of the overall project history, the equipment produced, techniques used, tests conducted, technical knowledge gained, and results. R.N.A.

N66-27558# Atomic Energy of Canada, Ltd., Chalk River (Ontario).

A PORTABLE TRITIUM-IN-AIR MONITOR

F. Sannes and B. Banville Jul. 1965 19 p

(AECL-2283) Available from Atomic Energy of Canada, Ltd., Chalk River: $0.20

A plastic scintillator detector was developed for the measurement of tritiated water vapor in air. The scintillations produced by the beta rays from tritium are detected by two photomultiplier tubes mounted on each end of the scintillator detector. A tunnel diode coincidence circuit and a three channel pulse height selector are employed to analyze the photomultiplier pulses. With this system, detection efficiencies of 20% were observed. Concentrations as low as 1 $\mu\mu$Ci/Ml or 0.2 MPC can be measured. An electronic circuit was incorporated into the instrument to make it less sensitive to external gamma radiation. The response time of the system to a sudden increase in tritium concentration in the sampled air is one minute, and approximately five minutes for a corresponding sudden decrease. Author (NSA)

N66-27566# Stanford Univ., Calif. High Energy Physics Lab.

DETERMINATION OF RELATIVE EFFICIENCIES FOR A MULTIDETECTOR SYSTEM

H. L. Crannell and L. R. Suelzle Dec. 1965 13 p refs Submitted for Publication

(Contract Nonr-225(67))

(HEPL-401; AD-631175) CFSTI: HC $1.60/MF $0.50

The greater accuracy of multidetector systems used in conjunction with magnetic spectrometers in high resolution electron scattering experiments has raised the problem of determining accurately the relative efficiencies of the individual detectors. A calibration technique utilizing an unknown spectrum of high energy scattered electrons is presented. Application to present equipment at Stanford University is discussed. Author (TAB)

N66-27653# Air Force Cambridge Research Labs., Bedford, Mass. Upper Atmosphere Physics Lab.

MINIATURE MASS SPECTROMETERS FOR UPPER ATMOSPHERE COMPOSITION MEASUREMENTS

Alan D. Bailey and Rocco S. Narcisi Feb. 1966 43 p refs *Its* Instrumentation Papers No. 95
(AFCRL-66-148; AD-631276) CFSTI: HC $2.00/MF $0.50

A basic quadrupole mass spectrometer system for neutral and ionized gaseous composition measurements of the upper atmosphere is described. Emphasis is placed on the electronic circuits used with a particular miniature quadrupole rod assembly and ionizer. Circuits described include the power converter, scan waveform generator, dc and rf excitation generators, logarithmic output current amplifier, ion source filament emission regulator and signal-conditioning circuits for telemetering. A summary of performance specifications and critical design dimensions is included.
Author (TAB)

N66-27707# Edgerton, Germeshausen and Grier, Inc., Boston, Mass.
DEVELOPMENT OF A READER FOR MINIATURE CONDENSER IONIZATION CHAMBERS
A. C. Lucas Bethesda, Md., Armed Forces Radiobiol. Res. Inst., Nov. 1965 27 p
(Contract DA-49-146-XZ-408)
(S-296-R; AFRRI-CR65-7; AD-631319) CFSTI: HC $2.60/MF $0.50

Tissue-equivalent condenser ion chambers of small size were constructed for use in studies of phantoms irradiated with gamma rays and neutrons. An instrument was designed, constructed, and tested that will measure the chamber discharge with high detectability, which is important in the conduct of experiments at long distances from neutron and gamma-ray sources.
Author

N66-27742*# Parametrics, Inc., Waltham, Mass.
ULTRASONIC TEMPERATURE MEASURING DEVICE Third Quarterly Progress Report
E. H. Carnevale, L. C. Lynnworth, and S. L. Kleidman Apr. 1966 27 p refs
(Contract NAS3-7981)
(NASA-CR-54964) CFSTI: HC $2.00/MF $0.50 CSCL 14B

Work proceeded on an evaluation of both piezoelectric and magnetostrictive transducers at both high and low frequencies. In addition, the design of the capsule for the radiation test has been agreed upon. Analysis of radiation effects has eliminated iridium as a possible sensor material. The calculations indicate that Cb, Mo and Re can be safely tested ultrasonically, without a hot cell, within two months after irradiation. Preliminary tests have been conducted at high temperatures in an rf oven. This oven is one of several being considered to provide a high temperature carbon free environment in which radiation effects on sound velocity can be measured. Additionally, construction of an automatic pulsing and receiving unit has begun.
Author

N66-27775# California Univ., Berkeley. Lawrence Radiation Lab.
THRESHOLD DETECTOR APPLICATIONS TO NEUTRON SPECTROSCOPY AT THE BERKELEY ACCELERATORS
Alan R. Smith 19 Nov. 1965 66 p refs Presented at 1st Symp. on Accelerator Radiation and Experience, Upton, N. Y., 3–5 Nov. 1965
(Contract W-7405-ENG-48)
(UCRL-16312; CONF-651109-19) CFSTI: HC $3.00/MF $0.75

Two systems of detectors are described. The first system consists of activation elments only, and provides neutron spectral information over the energy range 2 to 30 MeV. Among the activation elements are aluminum, carbon, cobalt, copper, iodine, iron, magnesium, nickel, and titanium. Induced activities are observed by γ-ray scintillation spectrometry, the only reasonable analysis method that permits extension of this technique to low intensities of neutron flux. Digital computer programs are used for γray spectral analysis, and are also used in calculation of the neutron spectra one seeks to determine. Some results obtained at the Bevatron are discussed in terms of the spectra themselves, and in terms of the unsolved problems attendant on this technique. Among these problems are complexities of γ-ray spectra, lack of neutron cross section data at energies higher than about 15 MeV, and production of desired activities by particles other than neutrons. The second threshold detector set consists of a mixed system of both pulse counters and activation elements, including moderated foil or BF_3 counters, aluminum disc, carbon (in the form of plastic scintillator), and bismuth fission counter. Detector information is related to the neutron spectrum over an energy range extending from about 0.02 MeV up to the primary particle energy. Data analysis involves use of a simple digital computer program which incorporates detector calibrations, reaction cross sections, and trial neutron spectra as input parameters. The objective of this program is to compute a detector response that matches the observed detector response; attainment of this goal defines the neutron spectrum "measured" by the detectors. The effects of reasonable variations of input parameters on calculated detector response are described, and an example of a neutron spectrum that fits data obtained at the Bevatron is discussed.
NSA

N66-27793# Naval Avionics Facility, Indianapolis, Ind.
ON PRODUCTION TEST EQUIPMENT FOR ALTIMETER WARNING TEST SET Final Report
Rolland Mc Master 21 Mar. 1966 14 p
(NAFI-TR-793; AD-631141) CFSTI: HC $1.60/MF $0.50

The AN/APM-254 is designed to test the Radar Altimeter Warning Set AN/APQ-107 at the flight line or shop level. It consists of a suitcase type housing containing a syncro, altimeter and bellows system, aural system, switches and panel lamps. The test set calibrates and functionally tests the RAWS unit utilizing visual and aural indications. Supertester is a tape-operated test system capable of measuring: ac and dc voltages, impedance, resistance, as well as continuity and leakage. The system contains bridge circuits for measurements, utilizing a floating (isolated from ground) 600-input two-wire system. Out-of-tolerance readings are indicated by means of an indicating lamp, buzzer, and printed test number. Manual and automatic control of the system is provided by a tape reader and control panel. Conclusions: Use of self-contained semi-automatic test systems (such as Supertester) on the Altimeter Warning Test Set program resulted in a substantial savings. The equipment lent itself to rapid incorporation of changes imposed by modifications to the field test set.
Author (TAB)

N66-27805# Institute of Modern Languages, Inc., Washington, D. C. Translation and Interpretation Div.
A NEW CAMERA TUBE, THE INFRACON
N. L. Artem'yev and V. N. Kornilov Apr. 1966 5 p ref Transl. into ENGLISH from Radiotekhn. i Elektron. (Moscow), v. 10, no. 10, 1965 p 1909–1910
(Contract DA-44-009-AMC-1563(T))
(ERDL-T-1829-66; AD-630687) CFSTI: HC $1.00/MF $0.50

A camera tube, the infracon, with a cooled photo-target for work in the 0.65 to 40-micron spectral region was investigated. A monocrystalline semiconductor material, working on the accumulation principle, was used as a photo-target. The photo-target turned out to be effective for the transmission of a television image in 0.65 to 40-micron spectral

region. When the tube was tested, parameters were obtained which testify to the possibility of obtaining television images of objects heated to a temperature of 125°C and higher. The threshold strength of irradiation at this temperature is approx. 0.1 microwatts/sq mm. The received image is practically inertialess. Author (TAB)

N66-27806# Navy Underwater Sound Lab., New London, Conn.

BROAD BANDWIDTH FREE-FLOODING MAGNETOSTRICTIVE SCROLL TRANSDUCERS

Theodore J. Meyers 22 Mar. 1966 20 p refs
(USL-723; AD-630770) CFSTI: HC $1.00/MF $0.50

Free-flooding magnetostrictive scroll transducers are rugged and reliable and are relatively insensitive to hydrostatic pressure; however, they normally have a relatively narrow bandwidth. This report describes the experimental results achieved in broadening the bandwidth of free-flooding magnetostrictive scroll transducers by coupling the cavity and ring resonances of the scrolls. Transducers with varying degrees of coupling between the cavity and ring resonances are considered. It would appear that the cavity resonance may have important use in this type of transducer and is deserving of further serious consideration.
Author (TAB)

N66-27820# American Meteorological Society, Boston, Mass.

THE MEASUREMENT OF THE FLUXES OF DISCRETE SOURCES OF COSMIC RADIO EMISSION AT FREQUENCIES BELOW 40 mHz [VYMIRIUVANNIA POTOKIV DYSKRETNYKH DZHEREL KOSMICHNOGO RADIOVYPROMINIUVANNIA NA CHASTOTAKH NYZHCHE 40 MGTS]

L. L. Bazelian, S. Ia. Braude, Iu. M. Bruk, I. M. Zhuk, A. V. Man' et al Jan. 1966 12 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Uk. RSR (Kiev), no. 2, 1963 p 188–192
(Contract AF 19(628)-3880)
(T-U-4; AD-630558) CFSTI: HC $1.00/MF $0.50

The purpose of the project was to measure the absolute flux densities of the emission of four discrete sources in frequency bands between 12 and 40 mHz: Cassiopeia A, Cygnus A, Taurus A, and Virgo A. In these experiments, which were performed in June to November 1961 and March to June 1962, two radio telescopes were used that had been developed at the radio astronomy laboratory of the Institute of Radio Physics and Electronics, Academy of Sciences of the Ukrainian SSR. One of these instruments operated in the 12–20 mHz band, and the other, in the 20–40-mHz band.
Author (TAB)

N66-27823# Naval Research Lab., Washington, D. C.

CHARACTERIZATION OF PARTICULATE MATTER IN THE OCEAN Final Report

L. S. Birks, J. S. Grosso, R. J. Labrie, J. W. Sandelin and D. J. Nagel 18 Mar. 1966 21 p refs
(NRL-6398; AD-631146) CFSTI: HC $1.00/MF $0.50

Electron micrographs of ocean filtrates collected near the surface at Key West, Block Island, and Chesapeake Bay show three common constituents: diatoms, plant fibers, and amorphous organic matter. In addition, material collected from layers giving strong sonar reflection at Key West and Block Island show numerous smaller iron-rich particles, probably a hydrated iron oxide, in the size range 0.01 to 0.1 micron. The iron particles are too small for X-ray diffraction but can be examined by X-ray fluorescence and electron probe analysis. In addition to iron, the particles show no other elements above atomic number 22, at least not above 1 percent composition. Author (TAB)

N66-27824# Army Personnel Research Office, Washington, D. C.

ABILITY OF IMAGE INTERPRETERS TO ADAPT OUTPUT TO VARYING REQUIREMENTS FOR COMPLETENESS AND ACCURACY

James A. Thomas and Robert Sadacca Dec. 1965 29 p refs /ts Tech. Res. Note 165
(AD-631178) CFSTI: HC $2.00/MF $0.50

Within the broad objectives of the Surveillance Systems research program, the Man Computer Functions Task is specifically concerned with the allocation of functions and interrelationships among interpreters and computers. The present publication describes an initial study, involving two experiments, in the development of procedures through which a computer can aid in the interpretation-decision process. The experiments were conducted to study the effect of providing payoff instructions based on specific intelligence requirements on image interpreter performance in two important tasks: (1) Location and identification of targets in tactical imagery and (2) Rapid screening of tactical imagery. Three sets of instructions were used in each experiment. One set emphasized importance of completeness of interpretation; another emphasized importance of achieving a balance between accuracy over completeness. Results of both experiments showed that interpreters can vary their performance as a function of the relative weight given accuracy and completeness of output. Positive results obtained in both experiments point up the need for provision of guidance to interpreters to offset highly variable and subjective evaluations given intelligence requirements. Development of payoff matrices for classes of military situations is suggested. Author (TAB)

N66-27837# Army Foreign Science and Technology Center, Washington, D. C.

SPRING-WOUND PSYCHROMETER, GOST 6353-52 AND ELECTRIC PSYCHROMETER M-34

Mar. 1966 22 p Transl. into ENGLISH from Russian
(FSTC-HT-23-54-66; AD-630858) CFSTI: HC $2.60/MF $0.50

These articles describe two almost identical wet and dry bulb comparison psychrometers. In each unit, a fan draws the surrounding air up through a tube past the wet and dry bulb thermometers, and tables or a special graph are used to determine the humidity, both relative and absolute, of the air. The essential difference between the two instruments is that one is spring-wound, the other has an electric motor.
Author (TAB)

N66-27877# American Electronic Labs., Inc., Colmar, Pa.

A STUDY TO IMPROVE CRYSTAL VIDEO DETECTORS Interim Technical Report, Jun.–Dec. 1965

J. Slowek Griffiss AFB, N. Y., RADC, Mar. 1966 94 p refs
(Contract AF 30(602)-3816)
(RADC-TR-66-59; AD-631270) CFSTI: HC $3.00/MF $0.75

Emphasis was directed at improving the sensitivity of crystal video detectors and at establishing a better understanding of the actual mechanisms involved in crystal video detection. A theoretical investigation led to the development of a series of expressions relating to detector conversion efficiency and noise behavior; these expressions permit the calculation of theoretically obtainable sensitivities. The influence of detector parasitic parameters on detector sensitivity is explained. A series of measurement techniques were developed which enable detector diode evaluation to be made in terms of conversion efficiency and noise properties. New semiconductor materials were evaluated for use as crystal video detectors. The materials evaluated include p- and n-type silicon, GaSb, GaAs,

and Ge. The highest tangential sensitivities presently obtained are −63 db_m for a 2 Mc video bandwidth and at an RF frequency of 2 Gc. Theoretically predicted sensitivity indicates that there is still an improvement of 4 db that can be made.
Author (TAB)

N66-27892# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONTACTLESS METHOD OF MEASURING TRUE TEMPERATURES
A. I. Mazo 17 Mar. 1966 8 p Transl. into ENGLISH from Russian Patent no. 167328 (Appl. no. 823819/26-10, 7 Mar. 1963) 2 p
(FTD-TT-65-1392/1+2+4; AD-630975) CFSTI: HC $1.10/MF $0.50

Object of the Invention: A contactless method of measuring the true temperatures of heated bodies which has the distinguishing feature that for the purpose of improving the precision of the measurement through the elimination of the effect of the properties of an intervening medium simultaneously, there are used two types of pickups, for example, a semiconductor thermal element and a photoelement or photoresistor with a narrow band light filter, the signals from which after amplification and differentiation are compared inside each channel with the derivative of the time signal, after which the signals are compared with each other, and the results of the comparison are taken from an automatic recording instrument.
Author (TAB)

N66-27907# Tracerlab, Inc., Waltham, Mass.
INVESTIGATION OF A NEW TYPE NARROW BAND X-RAY DETECTOR FOR THE IDENTIFICATION OF CHEMICAL ELEMENTS USING RADIOISOTOPE X-RAY SOURCES
Joris M. Brinkerhoff and Richard Forsyth 10 Dec. 1965 51 p refs
(Contract AT(30-1)-3160)
(NYO-3160-1) CFSTI: HC $3.00/MF $0.50

A new type narrow band X-ray detection system for the identification and measurement of chemical elements by means of radioisotope induced X-ray fluorescence was investigated. Good results were obtained for the low, medium, and high atomic number regions. An experimental prototype was constructed for the detection of gold.
NSA

N66-27938*# Virginia Univ., Charlottesville. Leander Mc Cormick Observatory.
DESIGN AND APPLICATIONS OF OPTICAL INTERFEROMETERS IN ASTRONOMY Final Report
Paul H. Knappenberger, Jr., H. John Wood, III, and Laurence Frederick 1966 76 p refs
(Grant NGR-47-005-031)
(NASA-CR-75634) CFSTI: HC $3.00/MF $0.75 CSCL 20F

Studies were made of the use of optical interferometers in astronomy, including the quality of telescopes under actual operating conditions, the shearing beam as a collimation tool for reflective telescopes, and beam interferometers. Results with the shearing prism were not promising, and the possibility of using Kösters prism as a stellar interferometer is considered. Reports and interferograms are included of the testing of the 32-inch fan mountain reflector at Leander McCormick Observatory, the 24-inch Cassegrain reflector at Mt. Cuba Observatory, and the 84-inch reflector at Kitt Peak. A method is described for obtaining values for the Seidel coefficients of spherical aberration, astigmatism, and coma using the data from the wave front shearing interferometer; and collimation and double star techniques, design of the Kösters interferometer, and stellar diameter measurements are discussed.
M.W.R.

N66-27939*# Princeton Univ., N. J. Dept. of Aerospace and Mechanical Sciences.
TRANSIENT PRESSURE MEASURING METHODS RESEARCH Summary Technical Report, 1 Jan.–30 Jun. 1965
J. P. Thomas 16 Nov. 1965 147 p refs *Its* Aeron. Eng. Rept.-595p
(Contracts NASr-36; NAS8-11216)
(NASA-CR-75632) CFSTI: HC $4.00/MF $1.00 CSCL 14B

Evaluations of transducers in the laboratory and in test rocket motors continued, with emphasis on noncooled transducers in cooled adapters and on variations of a small-passage technique. An advanced water-cooled, flush diaphragm transducer was not fully evaluated because of redesign and further development, but a study was made of heat transfer measurements in this model. Dynamic response of small-passage connected transducers to passage length and volume geometry was studied, and the digital computer analysis of the dynamic response of pressure transducers to shock inputs was continued. Gaskets, sealing, and other aspects of transducer mounting and installation were investigated.
M.W.R.

N66-27965*# National Research Corp., Cambridge, Mass.
DEVELOPMENT OF AN ACCURATE WIDE RANGE ULTRA HIGH VACUUM GAUGE CALIBRATION METHOD
Peter Fowler and F. J. Brock [1966] 112 p refs
(Contract NAS5-3967)
(NASA-CR-75529) CFSTI: HC $4.00/MF $0.75 CSCL 14B

A prototype accurate, wide range, vacuum gauge calibration system was designed, constructed, and tested to evaluate the components and performance of the system. The calibration method applies pressure attenuation, atomic beam, and cryopumping techniques to a system such that in a volume having extremely low background gas density, an atomic beam is formed which has a precisely known density that is variable over the useful range of operation of ion gauges and mass spectrometers. Orifice conductance of nearly ideal apertures was measured at pressures corresponding to Knudsen numbers as small as 0.75 for studying the free molecular flow deviation; and an accumulative error analysis of the calibration system was made to establish the absolute calibration accuracy attainable. The analysis showed that for the average probable error found to be attainable in the individual parameters, the accumulated probable error of the system could be maintained at less than 5%. A theoretical discussion of the gauge enclosure method and probable error in pressure for the calibration system is given. Electrical properties of the porous plug that is between the gas pressure source and the molecular furnace (providing pressure attenuation) are also discussed.
L.S.

N66-27969# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.
PHOTOGRAPHY
Miriam Sidran May 1966 14 p refs
(RM-325J)

Photographic processes and recent developments are reviewed in a paper which considers both conventional and color photography. It is pointed out that two recent developments are based on unconventional image-forming systems. (1) In lensless photography, a monochromatic light from a laser is split into two beams; one enters the camera directly while the other passes through a transparent image before entering the camera. (2) In the other process, a three-dimensional photograph, known as a parallax panoramogram, is produced on a two-dimensional card. The use of polaroid films, silver halide emulsions, and integral tripacks for color

photography is discussed. The dye coupling process for obtaining color negatives is described, as is instant color processing. Electrophotographic processes, using materials which exhibit an increase in electrical conductivity during light exposure, are discussed; and consideration is given to a process based on the persistent internal polarization effect in photoconductors. M.W.R.

N66-27971# Grumman Aircraft Engineering Corp., Bethpage, N. Y.

DEVELOPMENT OF IMPROVED PRESSURE TRANSDUCERS AND TRANSDUCER CALIBRATION TECHNIQUES FOR USE IN THE GRUMMAN HYPERSONIC SHOCK TUNNEL

Richard C. Jenkins and Harold B. Hopkins May 1964 40 p refs (RE-174)

Gauge evaluation and response, calibration methods, and the accuracy of surface pressure measurements are considered in relation to the development of pressure transducers for use in a hypersonic shock tunnel. Noise output from the piezoelectric transducers is reduced by the use of a relatively heavy stainless steel case for gauge construction; and potting the leads and crystals in epoxy protects them from rough handling and hot test gases. Both single and double crystal gauges are adequate, but the double crystal is most effective for measurement of low surface pressures when model acceleration effects are large. The calibration method developed can be used in the shock tunnel test section without removing the gauges from the model. Studies are also included of the effect of pressure rise time on gauge calibration and pressure measurement when test section conditions are not constant. M.W.R.

N66-27991# Japan Broadcasting Corp., Tokyo. Technical Research Labs.

AUTOMATIC LIGHT-CONTROL FILM PRINTER Technical Monograph No. 7

Haruso Sakata, Teiichi Teneda, and Hidehiko Kasama Feb. 1966 31 p ref

To print positive film from a negative film with a conventional film printer an operator must first determine the printing exposure value; then he must manually adjust the printer to this setting. NHK Technical Research Laboratories has developed an automatic light-control film printer to detect the negative film density and automatically adjust the printer to this correct exposure value by means of a servomechanism. A specially constructed CdSe cell is used in the detector for picking up the approximate maximum density of the negative film. In this manner the positive film minimum density remains nearly constant. Two control systems have been developed: one for continuous light control of each and every frame; the other, a step system to control every cut. The majority of NHK's film programs have been made employing this newly developed automatic light-control film printing system. Author

N66-28023*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

INVESTIGATION OF THE DEFLECTION OF AN ELECTRON BEAM AS A MEANS OF MEASURING ELECTRIC FIELD STRENGTH

E. L. Shriver 12 Apr. 1966 30 p refs (NASA-TM-X-53435) CFSTI: HC $2.00/MF $0.50 CSCL 14B

An electric field meter, which operates in the 1-V/m to 10-V/m range has been constructed and tested. Measurement of the deflection of an electron beam by the field in question is the principle of operation. The beam deflection distance is directly proportional to the magnitude of the deflecting field. Author

N66-28045*# National Bureau of Standards, Washington, D. C. Meteorology Div.

A NEW PHOTOELECTRIC FILTER SPECTRORADIOMETER AND ITS USE IN SPECTRAL SOLAR IRRADIANCE MEASUREMENTS AT TABLE MOUNTAIN

Ralph Stair and William R. Waters [1965] 22 p refs (NASA Order R-116)

(NASA-CR-75551; NBS-9300) CFSTI: HC $1.00/MF $0.50 CSCL 20F

A device using high transmission, narrow band interference filters to measure the ultraviolet irradiance of the sun is described in detail. Direct solar irradiance was collected in an integrating sphere coated with a thick layer of $BaSO_4$. A filter wheel carrying one wide band and nine narrow band interference filters, and two blanks was set at about six inches from the integrating sphere exit port, so that a narrow beam of ultraviolet flux passed through each filter onto a photoelectric cell. The filter wheel was step rotated by a synchronous motor and geneva drive mechanism. In this manner each filter and each blank was positioned for a period of approximately ten seconds, which is sufficient time for a pico-ammeter and a recorder to register a definite value. Thus the measurement of each solar spectral irradiance was registered once each revolution of the filter wheel. Each filter has a half band width of approximately 10 nanometers (nm), and its centroid is situated near even 10 nm intervals from 310 to 390 nm. The results and conditions of the measurements are presented in tabular form. D.T.

N66-28076# Texas Univ., Austin. Defense Research Lab.

[SOLION UNIVERSAL SEISMOMETER DEVELOPMENT—MATHEMATICAL ANALYSIS AND CALIBRATION] Quarterly Status Report, 1 Jul.-30 Sep. 1965

D. W. Evertson 24 Nov. 1965 28 p (Contract CGS-1198) (QSR-7)

Three solion universal seismometer units have been completed with improved construction features. An electronics package is included with each seismometer for response shaping and moderate voltage gain. The WWSS responses can be duplicated in each one. Some earthquake recording was done at the subsurface vault. A small horizontal shake table is nearing completion. Electromagnetic pumping is being considered as an alternative calibration method. An equation of motion has been derived for the solion universal seismometer. Author

N66-28088# United Kingdom Atomic Energy Authority, Harwell (England). Nuclear Physics Div.

THE ACCURATE MEASUREMENT OF THE RELATIVE EFFICIENCY OF Ge(Li) GAMMA-RAY DETECTORS IN THE ENERGY RANGE 500 TO 1500 KeV

J. M. Freeman and J. G. Jenkin Feb. 1966 26 p refs (AERE-R-5142)

A method is discussed for obtaining empirically the relative total-energy-peak efficiency, ϵ, over the gamma-ray energy range 500 to 1500 keV, for any given Ge(Li) detector in a specific geometry. Use is made of sources for which the relative emission rates of pairs of gamma rays are precisely known. An accuracy of about 1% in the relative efficiency curve is obtainable by use of the semi-empirical formula $\epsilon \propto \tau + \sigma A - BE$, where τ and σ are photoelectric and Compton

absorption coefficients respectively. E is the gamma-ray energy and A and B are constants determined from the gamma-ray measurements. Author

N66-28114*# Chicago Univ., Ill. Enrico Fermi Inst. for Nuclear Studies.

AN INSTRUMENT FOR LUNAR SURFACE CHEMICAL ANALYSIS

Anthony Turkevich, Karlfried Knolle, Richard E. Emmert, Wayne A. Anderson, James H. Patterson (Argonne Natl. Lab.), et al May 1966 44 p refs Submitted for Publication

(Contracts NAS7-100; JPL-950750; JPL-950315; Grant NsG-127-61)

(NASA-CR-76020; EFINS-66-49) CFSTI: HC $2.00/MF $0.50 GSCL 09A

An instrument has been designed and constructed which utilizes the interactions with matter of monoenergetic alpha particles for surface chemical analysis. The source of alpha particles is a radioactive nuclide, such as Cm^{242}. The energy spectra of backscattered alpha particles are measured with semiconductor detectors. Other detectors (with gold foils over them to eliminate alpha particles) register protons from (α,p) reactions. Transistorized electronics provide 128-channel pulse-height analyzers for both alpha and proton spectra. The specific unit designed for the Surveyor Lunar Mission weighs less than 4 kg and uses less than 1.3 watts. Author

N66-28126# United Kingdom Atomic Energy Authority, Harwell (England). Electronics and Applied Physics Div.

A SPHERICAL DOSE EQUIVALENT NEUTRON DETECTOR

J. W. Leake Feb. 1966 16 p refs

(AERE-R-4884)

A spherical neutron detector was designed which is a development of the Andersson and Braun counter, but which weighs only 11 lbs. The detector comprises a double polythene moderator system, with a lithium iodide (europium activated) crystal at the center which is viewed by a photomultiplier. The neutron energy response of the detector matches the recommendations of the ICRP (1963) within ±50% for neutrons with energies between 200 keV and 10 MeV, the sensitivity falling above 10 MeV. Below 200 keV the sensitivity increases above the required value to a maximum at 5 keV where it overestimates by a factor of 3-1/2 times. At thermal energies the response is high by a factor of 3-1/4 times.

Author

N66-28148# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf (Austria). Institut für Strahlenschutz.

METHODS FOR DETERMINING THE LEAST IMPULSE RATE AND DETECTION BOUNDARY OF AN INSTRUMENT FOR MEASURING RADIOACTIVE RAYS [METHODEN ZUR ERMITTLUNG DER MINDESTIMPULSRATE UND NACHWEISGRENZE EINES MESSGERAETES BEI DER MESSUNG RADIOAKTIVER STRAHLEN]

Oe. A. Soyberk 1966 18 p refs In GERMAN Submitted for Publication Supported in part by the Intern. Atomic Energy Agency

(SGAE-SS-5/1966) CFSTI: HC $1.00/MF $0.50

Determination of the detection limit of a radiation detection instrument for radiotoxic nuclides is demonstrated. The least impulse rate of the instrument is obtained through consideration of negative-value pulses, negative value, and sample measuring time. Method and equations are given; a safety factor K is introduced to allow for error.

Transl. by K.W.

N66-28153# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.

AUTORADIOGRAPHIC EXPERIMENTS IN THE ELECTRON MICROSCOPE USING THE TECHNIQUE OF SALPETER AND BACHMANN [PROVE DI AUTORADIOGRAFIA AL MICROSCOPIO ELETTRONICO SECONDO LA TECNICA DI SALPETER E BACHMANN]

F. Rosati Valente 17 Feb. 1966 39 p refs In ITALIAN; ENGLISH summary Sponsored by the Consiglio Nazl. delle Ric.

(ISS-66/5) CFSTI: HC $2.00/MF $0.50

The resolution limits of the electron microscope imposed by the use of autoradiographic techniques are discussed, along with the general sensitivity of autoradiographic methods. In addition, the various experiments performed in an attempt to reproduce the technique proposed by Salpeter and Bachmann for the use of the nuclear emulsion Kodak NTE are described. D.T.

N66-28174# Aeronautical Research Labs., Melbourne (Australia).

DETERMINATION OF DIRECTED DISTANCES IN OBJECTS EXAMINED IN THE ELECTRON MICROSCOPE

J. F. Nankivell Jul. 1965 28 p ref

(ARL/MET-26) CFSTI: HC $2.00/MF $0.50

It is shown that if electron micrographs of specimens in the untilted and tilted positions used for normal and stereoscopic viewing are obtained, then simple measurements of distances and angles enable the lengths and orientations of lines joining pairs of object points to be determined. Instrumental factors which might introduce errors in orientation exceeding 1° are discussed and the requirements of a goniometer stage which would permit the inherent precision of the technique to be achieved are briefly listed. Author

N66-28180# Royal Aircraft Establishment, Farnborough (England).

SENSITIVITY AND LIMITS OF USE OF THE THERMOELECTRIC OSOMETER IN DETERMINING THE MOLECULAR WEIGHTS OF POLYMERS [SENSIBILITA E LIMITI DI IMPIEGO DELLA OSOMETRIA TERMOELETTRICA NELLA DETERMINAZIONE DEI PESI MOLECOLARI DI POLIMERI]

G. Montaudo and F. Romano Feb. 1966 17 p refs Transl. into ENGLISH from Chim. Ind. (Milan), v. 47, no. 3, Mar. 1965 p 305–307

(RAE-LIB-TRANS-1151) CFSTI: HC $1.00/MF $0.50

The variation in the sensitivity in terms of thermoelectric measurements has been studied by measurements in various solvents at different temperatures. High temperatures and volatile solvents increase the sensitivity and the limits of use of the thermoelectric osmometer in determining the molecular weights of polymers. A relationship has also been deduced which allows the quantitative evaluation of the sensitivity and the ratio of sensitivity obtainable for a given system.

Author

N66-28182# Japan Broadcasting Corp., Tokyo. Broadcasting Science Research Labs.

THE IMPROVEMENT OF THE FILM RECORDING SYSTEMS Technical Monograph No. 8

Kozo Hayashi, Soichi Iwamura, Junkichi Bessho, and Takushiro Takagi Mar. 1966 80 p refs

Several papers are presented which deal with the improvement of the quality of pictures for and the operation of film recording systems. Following a general discussion of existing conditions and problems, a paper is devoted to gradation, resolution, and noise. A newly-developed recording

cathode-ray tube and assembly is described in which resolution is improved by 4.3 dB at 8 Mc as compared with the conventional tube. A specially-developed film for recording is also described which exhibits more sensitivity and granularity than existing films. Attention is given to the development of viscous agents for this type of blue-sensitive film, and methods of analyzing viscous developers are discussed. M.W.R.

N66-28191# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Porz (West Germany). Institut für Angewandte Gasdynamik.

CONTRIBUTION TO THE DEVELOPMENT OF LIQUID-LEVEL INDICATION FOR FUEL TANKS FILLED WITH AGGRESSIVE LIQUIDS STANDING UNDER HIGH GAS PRESSURE [BEITRAG ZUR ENTWICKLUNG EINER FUELLSTANDSANZEIGE FUER BEHAELTER MIT AGRISSIVEN FLUESSIGKEITEN, DIE UNTER HOHEM GASDRUCK STEHEN]

Josef Thelen, Wolf Trommsdorff, and Herbert Wiegand Feb. 1966 30 p refs In GERMAN; ENGLISH summary
(DLR-MITT-66-01; DVL-468) CFSTI: HC $2.00/MF $0.50

This report deals with different methods for measuring the liquid-level in closed fuel tanks. A method with a capacitative probe which seems to be especially qualified for fuel tanks with aggressive liquids standing under high gas pressure is tested in detail. Finally applicabilities for which the introduction of this method may be of importance are discussed. Author

N66-28193# Ontario Research Foundation, Toronto. Dept. of Physics.

THE ELECTRON-SINGLE-SCATTER GAUGE—A NEW VACUUM GAUGE FOR THE RANGE FROM 10^{-5} TORR TO 1 TORR Final Report

B. W. Schumacher, E. Aruja, and H. R. Falckenberg [1965] 49 p refs Presented at the 3d Intern. Vacuum-Congr., Stuttgart, 28 Jun.–2 Jul. 1965
(Contract DRB-PW-69-200029)
(Rept.-6501) CFSTI: HC $2.00/MF $0.50

An electron beam or beta-rays are fired through the vacuum space over a path length of about 50 cm. This primary beam is intercepted by a beam stop. The single-scatter in the acute forward direction of some of the electrons by the residual gas molecules is measured by scintillation counters or solid state detectors. Scattering from anywhere in the beam path is counted, and no electron optics is employed. With an electron beam of 40, 60, or 80 keV the scatter-count for constant primary current (in the order of 10^{-12} Å) was found to be a linear function of pressure between 0.1 Torr and 10^{-5} Torr. This agrees closely with predictions from scattering theory. With a beta-emitting isotope source, about 500 mC of Pm-147, in a light-weight gauge structure a useful working range from 10^{-3} Torr to 0.2 Torr was found. These gauges measure the vacuum in "free" space far from walls and structure elements of the gauges themselves. There is no inherent outgassing or gettering effects. Author

N66-28197# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.

LECTURES ON ELECTRON MICROSCOPY. I: INTRODUCTION TO ELECTRON MICROSCOPE-FUNDAMENTAL PRINCIPLES AND ELECTRON MICROSCOPE DESIGN

R. W. Horne (Agr. Res. Council, Cambridge, England) 23 Jun. 1965 34 p
(ISS-65/23) CFSTI: HC $2.00/MF $0.50

This report deals with the basic principles of the electron microscope, the various controls of the apparatus, their function, and their use. Author

N66-28205# Forest Products Research Lab., Vancouver (British Columbia).

A COMPUTER PROGRAM FOR EVALUATION OF STRAIN GAUGE ROSETTE READINGS

C. K. A. Stieda Oct. 1965 20 p refs
(VP-X-4) CFSTI: HC $1.00/MF $0.50

A description is given of a program for computing shear strains and principal strain directions in structures. The program is written in Fortran IV for use with the IBM 7040, but can be used with any other computer that is programmed for Fortran IV. It is designed to utilize the readings obtained from two pairs of gauges, each consisting of two gauges oriented exactly at right angles to each other. The deviations of individual from average calculated values serve as an indication of the accuracy of the strain observations. C.T.C.

N66-28261# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

OBSERVATION OF CREPUSCULAR PEAK OF EMISSION OF HELIJM λ 10,830 Å WITH THE AID OF THE FABRY-PEROT STANDARD

P. V. Shcheglov 23 Mar. 1966 7 p refs Transl. into ENGLISH from the publ. "Mezhduvedomstvennyy Geofizicheskiy Kom., Resul'taty Issled. Po Programme Mezhdunarodnogo Geofizicheskogo Goda, Polyarnyye Siyaniya i Svecheniye Nochnogo Neba" Moscow, AN SSSR, no. 9, 1963 p 59–60
(FTD-TT-65-1635/1+2+4; AD-631580) CFSTI: HC $1.10/MF $0.50

A description is given of a monochromator having unusually high transmission and of experiments involving use of the device to observe the helium λ 10,830 Å line in twilight. TAB

N66-28258# Dayton Univ., Ohio. Research Inst.

GONIOPHOTOMETER TO MEASURE DIFFUSION CHARACTERISTICS OF REAR PROJECTION SCREENS Final Report, Dec. 1964–Oct. 1965

Edgar A. Smith (AMRL), Guy S. Williams and Henry T. Mohlman Wright-Patterson AFB, Ohio, AMRL, Dec. 1965 28 p
(Contract AF 33(615)-2348)
(AMRL-TR-65-207; AD-631315) CFSTI: HC $2.00/MF $0.50

A goniophotometer was developed for use in measuring the diffusion characteristics of rear projection screen materials. Rear projection screens provide a wide range of possible diffusion characteristics. Similarly, different applications require different characteristics. The goniophotometer will facilitate the selection of screens most suitable for a particular application. Primary components of the device include a light tight chassis, a light source mounted on an arm which can be rotated ±60°, a holder for screen specimens, a specifically designed photometer, and two interior ambient light panels and associated interior foot candle meters. Schematics, wiring diagrams, and drawings necessary for the fabrication of additional units are included. Author (TAB)

N66-28274# Engineering-Physics Co., Rockville, Md.

PARTICLE VELOCIMETER FOR USE CLOSE-IN TO UNDERGROUND EXPLOSIONS, PHASE IV

William L. Danek, Jr. and Algimantas A. Dargis 31 Dec. 1965 93 p refs
(Contract DA-49-146-XZ-224)
(DASA-1431-2; AD-631496) CFSTI: HC $3.00/MF $0.75

Phase IV has consisted of designing a power supply to provide the high currents required and incorporating the power supply into the gage body, examining methods of increasing

the signal gain of the velocimeter in order that the practical measurement range of the gage in field use may be extended down to velocities of tens of meters per second, determining the most suitable data recording method for use with the gage in the field, and improving the shock velocity generator utilized in laboratory tests. This report describes these Phase IV activities in their detail. TAB

N66-28278# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INTERPRETOSCOPE, NEW PHOTOGRAMMETRIC DEVICE PRODUCED BY THE VEB C. ZEISS-JENA
J. Konieczny 23 Mar. 1966 7 p Transl. into ENGLISH from Przgl. Geofiz. (Poland), v. 36, no. 12, 1964 p 475-476 (FTD-TT-65-1727/1+2+4; AD-631582) CFSTI: HC $1.10/MF $0.50

The interpretoscope, a device to enable proper and full interpretation of aerial photographs for map processing, is briefly described. The device consists basically of optical components for stereoscopic observation of photographs, base, and desk for insertion of photographs. The magnification, brightness control, and the adjustments in the x and y directions are mentioned. The large field of vision and high picture quality are indicated. N.E.N.

N66-28296# Army Foreign Science and Technology Center, Washington, D. C.
RESULTS OF A SYMPOSIUM ON APPLICATION OF ELECTRONIC TECHNOLOGY FOR THE MEASUREMENT OF DISTANCES
G. M. Karlov Mar. 1966 11 p Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), no. 11, Nov. 1965 p 25-29 (FSTC-HT-23-70-66; TT-66-61050; AD-631277) CFSTI: HC $1.10/MF $0.50

Brief specifications are given for several modern photo- and radio-range finders developed in E. Germany, USSR, Hungary, and Czechoslovakia; these devices were described, discussed and demonstrated at a symposium held in Dresden, E. Germany from 11 to 21 May 1965. The need to achieve a further weight reduction and improvement in accuracy of existing range finders was stressed. Author (TAB)

N66-28335# Royal Aircraft Establishment, Farnborough (England).
REDUCTION OF ERRORS IN MAGNETIC ASPECT SENSORS BY A SYSTEM OF GROUND CALIBRATION
C. T. Farr and E. A. R. Anstey Mar. 1966 37 p ref (RAE-TR-66092) CFSTI: HC $2.00/MF $0.50

The report discusses the limitations and sources of error introduced into magnetic aspect sensors when installed in a sounding rocket. Typical values of the errors resulting from the magnetic properties of the rocket and its associated electromagnetic instrumentation are given. An attempt to reduce the errors by pre-flight calibration of the rocket head is discussed, and the techniques employed in the method given. Other methods by which the errors may be reduced are indicated. Results obtained from the ground measurements are presented and from these it is concluded that the procedure allows the magnetometer data to be corrected, so that measurements give the magnitude and direction of the applied field with an *rms* vector error of less than 0.0005 oersteds. Author

N66-28376*# Melpar, Inc., Falls Church, Va.
SPACEBORNE GAS CHROMATOGRAPH Final Report, 24 Feb. 1964-1 May 1966
Apr. 1966 95 p refs
(Contract NAS9-2518)
(NASA-CR-65379) CFSTI: HC $3.00/MF $0.75 CSCL 14B

Fabrication of flight qualified gas chromatography detectors is summarized. In the development of the gas chromatography system, innovations were made in column and detector technology, sample injection techniques, and basic electronics. The systems as delivered potentially can separate and detect approximately 75 compounds at detection sensitivity levels approaching a few parts per million. The gas chromatography detector is completely automated and will function on a repetitive analytical cycle without attention for a minimum of 15 days. Author

N66-28378*# Cambridge Systems, Inc., Newton, Mass.
DESIGN, DEVELOPMENT AND TESTING DEW POINT HYGROMETERS FOR THE NASA/GEMINI PROGRAM Final Report, 27 Jun. 1965-31 Jan. 1966
31 Jan. 1966 34 p refs
(Contract NAS9-4793)
(NASA-CR-65380) CFSTI: HC $2.00/MF $0.50 CSCL 14B

This document describes the design, development, and testing of a dew point hygrometer system for use in the NASA/Gemini Manned Spaceflight Program. The system is a hand held instrument designed to measure and visually display the dew point, ambient, and surface temperatures inside a spacecraft. The information in this document covers the background and requirements for development of the system, major milestones in the performance of the contract, description of the resultant configuration, highlights of the engineering development, summaries of qualification and acceptance testing results, and recommendations for additional engineering development of future systems. Author

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N66-26893# Joint Publications Research Service, Washington, D. C.
PREPARING ALUMINUM MIRRORS ON ASBESTOS CEMENT BY THE TRANSFER METHOD
G. Ya. Umarov, S. N. Vil'kova, Ye. L. Ayzenshtat, I. A. Novikova, and V. M. Sutyagina *In its* Heliotechnology, No. 3, 1965 26 Apr. 1966 p 37-43 refs (See N66-26887 15-33) CFSTI: $3.00

Methods and materials are described for constructing vapor deposited or bonded aluminum thin film mirrors for use in solar power plants. The supporting body of the collector was asbestos cement. Since the asbestos could not be directly coated or bonded with the aluminum, it was covered with a layer of epoxy resin, which was mixed with a filler to decrease the absorption coefficient. After several attempts at polymerization and tests of different fillers, a smooth hard surface was obtained with a reflectivity coefficient of approximately 90%. The aluminum was bonded to the resin by the following transfer process. First, the metal was vaporized onto a glass surface; then, this aluminized surface was superimposed on the resin at the beginning of polymerization. During polymerization, the

aluminum was transferred to the resin, and upon completion the glass was simply removed. This method, it is pointed out, produced adhesion which was five to six times greater in strength than the adhesion of direct vapor deposition to the epoxy resin surface. D.T.

N66-26945# Joint Publications Research Service, Washington, D. C.
ON A SET OF PROBLEMS IN THE SOLUTION OF COMPLETE AUTOMATION OF PRODUCTION
B. N. Avdeyev and V. I. Obukhov 4 May 1966 9 p Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Minsk), v. 10, no. 2, 1966 p 87–89
(JPRS-35329; TT-66-31765) CFSTI: $1.00

The basic problems besetting the complete automation of various production processes are briefly discussed. An approach is proposed, based on the use of structural cartograms, for solving these problems, which include in their number questions of design, technology, physics, mathematics, chemistry, economics, bionics, and man–machine relationships. D.T.

N66-26962# Joint Publications Research Service, Washington, D. C.
TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY NO. 300
17 Mar. 1966 35 p refs Transl. into ENGLISH from Chinese (JPRS-34594; TT-66-31033) CFSTI: $2.00

CONTENTS:

1. A HOT-WIRE WIND TUNNEL TURBULENCE SPECTRAL ANALYZER C.-h. Ma and H.-y. Li p 1–9 refs (See N66-26983 15-14)

2. PRINCIPLES OF STRUCTURAL METALLURGY p 10–24

3. ULTRASONIC CUTTING OF GERMANIUM AND SILICON PLATES T.-y. Chou, H.-c. Chu, T.-a. Chang, and T.-m. Sun p 25–28 (See N66-26964 15-15)

N66-26964# Joint Publications Research Service, Washington, D. C.
ULTRASONIC CUTTING OF GERMANIUM AND SILICON PLATES
T'ieh-ying Chou, Huo-chen Chu, Tai-an Chang, and Te-ming Sun *In its* Transl. on Communist China's Sci. and Technol. 17 Mar. 1966 p 25–28 Transl. into ENGLISH from Ch'inghua Ta-hsueh Hsueh-pao (Communist China), v. 12, no. 2, Jun. 1965 p 85–86 (See N66-26962 15-15) CFSTI: $3.00

A high speed tool is described for cutting large germanium and silicon plates into small squares. The tool consists of a row of parallel razor blades at the end of a shaft, which is oscillated at ultrasonic frequencies. It is reported that the use of this machine, rather than a conventional molybdenum saw, increased production in terms of reduced material waste by 68%, and in terms of units per eight hour day by 520%. D.T.

N66-27008# Naval Research Lab., Washington, D. C.
REPORT OF NRL PROGRESS
Jan. 1966 52 p refs
(PB-169123)

CONTENTS:

1. FACTORS AFFECTING THE ICING RESISTANCE OF LUBRICANTS FOR AIRCRAFT ORDNANCE H. R. Baker and R. N. Bolster p 1–5 refs (See N66-27009 15-15)

2. A RATE "SPECTRUM" OF STRAIN HARDENABILITY AND OF FRACTURE TOUGHNESS J. M. Krafft p 6–16 refs (See N66-27010 15-17)

3. ATMOSPHERE AND ASTROPHYSICS L. B. Lockhart, Jr., and R. L. Patterson, Jr. p 17–18

4. METALLURGY AND CERAMICS R. W. Hubert et al p 18–30 refs

5. RADIO J. E. Rogerson et al p 30–32 refs

6. SOLID STATE PHYSICS H. B. Rosenstock, G. Blanken et al p 32–34 refs

7. SOUND M. Flato and F. M. Crum p 34–37 refs

8. PATENTS p 39–40

9. INDEX OF UNCLASSIFIED REPORTS (JANUARY–DECEMBER 1965) p 40–46

N66-27009# Naval Research Lab., Washington, D. C.
FACTORS AFFECTING THE ICING RESISTANCE OF LUBRICANTS FOR AIRCRAFT ORDNANCE
H. R. Baker and R. N. Bolster *In its* Rept. of NRL Progr. Jan. 1966 p 1–5 refs (See N66-27008 15-15)

Recent samples of the all-weather semifluid lubricant for aircraft ordnance, obtained both from manufacturers and from Navy stocks, have failed to meet the cold-sweat-cold gun firing test required by Military Specification MIL-L-19701 (NOrd). These failures were due to ice adhesion attendant on the poor water resistance of the lubricants. The probable cause of the loss in water resistance was the presence of surface-active impurities, such as sodium soaps and soaps of myristic and oleic acids, in the lithium stearate thickener. A lubricant of altered formulation has been developed that is superior to the original. Variations in consistency over a wide temperature range are much less, and resistance to water and to ice adhesion are increased. It has been used successfully to lubricate the Mk 12 machine gun equipped with the Mk 7 pneumatic feeder under ambient temperature and cold-sweat-cold conditions. Author

N66-27018# Fansteel Metallurgical Corp., North Chicago, Ill. Metals Div.
FABRICATION OF FANSTEEL 85 METAL SHEET Quarterly Report, Jun. 24–Sep. 24, 1965
John W. Davis and R. M. Curcio Sep. 1965 30 p
(Contract NOw-65-0498-f)
(QR-1)

This report describes the preparation and consolidation of two 9" diameter columbium base alloy (Fansteel 85) ingots. The ingots were subsequently tested and processed to 2"x 7" sheet rolling slabs. Author

N66-27044*# National Aeronautics and Space Administration, Washington, D. C.
METHOD OF FABRICATING SILICON CARBIDE SHAPES [VERFAHREN ZUR HERSTELLUNG GEFORMTER KORPER AUS SILICIUMCARBID]
Eduard Enk and Julius Nickl Aug. 1963 5 p refs Transl. into ENGLISH from German Patent No. 1088863, 8 Sep. 1960
(NASA-TT-F-8478) CFSTI: HC $1.00/MF $0.50 CSCL 13H

A new method is developed for making silicon carbide shapes that are suitable as semiconductors by siliconizing performed graphite or technical silicon carbide bodies at a high temperature in a gas containing silicon. This method is characterized in that the gas atmosphere containing silicon is produced by means of hydrogen-containing or hydrogen-free silicon halides (where necessary in the presence of hydrogen or compounds that split off hydrogen). J.L.D.

N66-27050*# Carbons, Inc., Boonton, N. J.
SOLAR CARBONS Final Report No. 10
27 Jul. 1965 39 p
(Contract NAS9-3698)
(NASA-CR-65361) CFSTI: HC $2.00/MF $0.50 CSCL 13H

This report summarizes the different approaches used in studies of the shell, core, and glue. With respect to the shell, studies were oriented to avoid shell breakage at the strike or during burning. Methods were investigated to obtain a straight edge on the crater to minimize rim scalloping. With respect to the core, the study was concerned with obtaining regularity in the emission of vapors. In relation to the glue, the study involved insuring a good binding between the core and shell. Included are descriptions of the shell and core tests; a study of the clearance and glue between shell and core; a study of the joints between carbons; the manufacturing and control processes for the shell, core, and the glue between shell and core; final control of the electrodes in the arc lamp; and results obtained with the new electrodes. R.N.A.

N66-27083*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COMPONENT HARDNESS DIFFERENCES AND THEIR EFFECT ON BEARING FATIGUE

E. V. Zaretsky, R. J. Parker, and W. J. Anderson [1965] 17 p refs Presented at the Lubrication Conf., San Francisco, 11–13 Oct. 1965 Sponsored by ASME and Am. Soc. of Lubrication Engr.

(NASA-TM-X-52087) CFSTI: HC $1.00/MF $0.50 CSCL 13I

The five-ball fatigue tester and full-scale rolling-element bearings were used to determine the effect of component hardness differences of SAE 52100 steel on bearing fatigue and load capacity. Maximum fatigue life and load capacity are achieved when the rolling elements of a bearing are one to two points (Rockwell C) harder than the races. There appears to be an interrelation among compressive residual stresses induced in the races during operation, differences in component hardness, and fatigue life. Differences in contact temperature and plastically deformed profile radii could not account for differences in fatigue life. Author

N66-27090# California Univ., Berkeley. Lawrence Radiation Lab.

HIGH-TEMPERATURE COMPRESSIVE DEFORMATION EQUIPMENT

C. O. Hulse and S. M. Copley 27 Oct. 1965 20 p refs (Contract W-7405-ENG-48)

(UCRL-16434) CFSTI: HC $1.00/MF $0.50

Three apparatus for deforming ceramic materials in compression at elevated temperatures were developed. Methods used for loading, alignment, and measurement of stress and strain are described. Author (NSA)

N66-27093# Sandia Corp., Albuquerque, N. Mex.

DESIGN CONSIDERATIONS FOR ION PLATING

D. M. Mattox Jan. 1966 64 p refs (Contract AT(29-1)-789)

(SC-R-65-997) CFSTI: HC $3.00/MF $0.50

A discussion is given of the important design considerations useful in setting up and using apparatus for ion plating. Apparatus and techniques which have proven to be reliable are presented and discussed. Reviews of sputtering and gaseous electronics as applied to ion plating are given in the Appendices. Author (NSA)

N66-27138# Los Alamos Scientific Lab., N. Mex.

FABRICATION OF PRECISION LEAD COLLIMATORS

Hermann M. Ruess 24 Jan. 1966 16 p (Contract W-7405-ENG-36)

(LA-3443) CFSTI: HC $1.00/MF $0.50

A fabrication technique was developed for the manufacture of precision lead collimators with slits or round holes. A precision casting process is used to obtain collimators of such quality that no subsequent machining is necessary. Mold design specifications, casting procedure, and recommendations based on test results are included. Author (NSA)

N66-27149# California Univ., Livermore. Lawrence Radiation Lab.

VACUUM COMPONENT DEVELOPMENTS

Thomas H. Batzer *In its* Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res. [1965] p 10–13 (See N66-27146 15-25) CFSTI: HC $6.00/MF $1.25

Vacuum components that have been successfully developed include all-metal gate valves, aluminum foil seals, cryopumps, and clean rough-pumping systems using a water aspirator and zeolites. Development of the design of these components is discussed, together with test results. Author

N66-27150# Oak Ridge National Lab., Tenn.

A NEW, VERSATILE, VACUUM QUICK-SEAL AND VACUUM LOCK

O. D. Matlock *In* Calif. Univ. Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res. [1965] p 18–19 (See N66-27146 15-25) CFSTI: HC $6.00/MF $1.25

A convenient quick-seal and vacuum lock has been developed for rapid and inexpensive installation of probes, leads, lines, or shafts in existing equipment or future equipment where welding, soldering or drilling, and tapping is a problem. The quick-seal is installed by simply drilling a hole 1/8 in. larger than the size of probes or lines; no tools are required other than an Allen wrench for assembly. Systems have been developed for probe sizes from 1/4-in. through 3/4-in. diameter. The valve assembly is a compact integral valve, air lock, and pump-out system which was designed to be compatible with the quick-seal. It has the unique feature that the gland seal at the front may be tightened after pump-out and insertion of probes, etc., in order to isolate the volume behind, thus avoiding possible virtual leaks from this part of the assembly. Author

N66-27182*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

THE FABRICATION OF SEAMLESS TEFLON PROPELLANT EXPULSION BLADDERS

R. N. Porter 15 Jun. 1966 32 p refs (Contract NAS7-100)

(NASA-CR-75332; JPL-TR-32-914) CFSTI: HC $2.00/MF $0.50 CSCL 13H

Seamless Teflon bladders of TFE, FEP, or a combination of both are fabricated by several firms for the NASA Space Program. The process involves mixing aqueous dispersions of Teflon particles, spraying this dispersion onto a metal mandrel, sintering the particles into a film and then etching out the metal mandrel. Teflon bladders made in this manner are reasonably compatible with propellants and capable of repeatedly expelling propellants, but they are somewhat permeable to propellants. Production of defect-free bladders requires a concerted quality control program to monitor every step in the process. Author

N66-27232*# Westinghouse Electric Corp., Pittsburgh, Pa. Research Labs.

LUBRICANT STUDY IN ULTRAHIGH VACUUM AND IN VARIOUS GAS ENVIRONMENTS Final Report, 26 Jan. 1965–15 Mar. 1966

P. H. Bowen, D. J. Boes, K. W. Grossett, and E. S. Bober [1966] 155 p refs
(Contract NAS9-3815)
(NASA-CR-65374) CFSTI: HC $5.00/MF $1.00 CSCL 11H

Wear and friction characteristics of lubricated and unlubricated hardened stainless steel couples in sliding and rolling contact were studied in an ultrahigh vacuum environment and in an UHV environment degraded by outgassing products known to exist in spacecraft. The lubricants were of the fluid, laminar film, and solid composite types. The UHV environments were degraded by high purity CO_2, O_2, and H_2O vapor. Results are compiled and presented in graphic form. Lubrication effectiveness is presented by a comparison of measured friction values and of the metal component wear rates. Selected wear surfaces were analyzed by various laboratory techniques. The best overall lubrication was obtained with a Na_2SiO_3 bonded WSe_2 laminar film, followed by chlorophenyl methyl silicone oil. A self-lubricating composite wiper material was satisfactory to marginal lubrication and was more effective on rolling surfaces than on sliding contact surfaces. The H_2O vapor degraded UHV environment provided the most beneficial effect to lubricants. The composite lubricated surfaces received the least benefit and in several tests the effect was slightly detrimental. R.N.A.

N66-27274# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Aero Propulsion Lab.
MAINTENANCE TECHNOLOGY FOR SPACE SYSTEMS
Chester B. May *In its* Aerospace Expandable Struct. [1966] p 179-197 refs (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

The states-of-the-art in various technological disciplines with respect to their use for establishing design criteria to maintain, assemble, and repair vehicles in a space environment are defined. The overall objectives of space maintenance technology are as follows: (1) to develop tools and techniques; (2) to establish design criteria for fabrication of systems maintainable in a space environment; (3) to develop and utilize abstract models for maintenance planning; and (4) to design and fabricate test models for verification of man's ability to perform repairs in the various technologies used in space. The specialized areas discussed include joining techniques; maintenance operations, assembly techniques, electrical systems repairs, and utilization of abstract models. D.T.

N66-27397# Institut de Soudure, Paris (France).
EXECUTION AND RESULTS OF WELDING TESTS ON SAMPLE SECTION TAKEN FROM HEAVY-GAGE PLATES OF ROLLED STEEL Final Report No. 1
H. Granjon and R. Gaillard Nov. 1965 90 p Transl. into ENGLISH from French
(Contract EURATOM-090-62-12 RDF)
(EURAEC-1517; EUR-2669) CFSTI: HC $3.00/MF $0.75

Specimens were cut from 200 mm thick LMS2V Mn-Mo steel plate with their axes parallel and perpendicular to the rolling direction. Weld beads were applied by arc welding with coated electrodes, submerged arc welding, and gas metal-arc welding. The thermal cycles during the welding processes were measured and correlated with the hardness of the heat affected zones and the underbead cracking due to the H_2 diffusion from the weld metal to the base metal. Pellini tests were also made on sections of welded or unwelded plates. NSA

N66-27437# Army Foreign Science and Technology Center, Washington, D. C.
WELDING OF TEFLON AND OTHER ORGANIC MATERIALS
I. M. Barkalov, V. I. Gol'danskiy, B. G. Dzantiyev, and Ye. V. Yegorov Jan. 1966 12 p refs Transl. into ENGLISH from Tr. 2-Go Vses. Soveshch. po Radiats. Khim., Akad. Nauk SSSR, Otd. Khim. Nauk (Moscow), 1962 p 616-620
(FSTC-HT-23-23-66; TT-66-60952; AD-630847) CFSTI: HC $1.00/MF $0.50

A method is described for localizing the effect of ionizing radiation when welding polymeric materials with thermal neutrons. The method is based on the treatment of the surfaces to be welded with compounds of boron and lithium. TAB

N66-27449# California Univ., Livermore. Lawrence Radiation Lab.
HIGH TEMPERATURE TESTING OF GRAPHITE HELICAL-SCREW EXPANDERS AND COMPRESSORS
W. M. Wells, D. W. Hanner, J. L. Mc Elroy, and E. Robinson 21 Jan. 1966 65 p refs
(Contract W-7405-ENG-48)
(UCRL-14660) CFSTI: HC $3.00/MF $0.75

In a simple demonstration, a graphite helical-screw compressor drove an identical expander with temperatures on the low pressure side to 2730°F. Gas temperature on the high pressure side was uncertain in detail, but the temperature in the pyrometric well was as high as 135°F above the outside case temperature. This well temperature was below the actual gas temperature, but the difference was not assessed. Rotational speeds to over 14,000 rpm and tip speeds to 230 fps were achieved in the compressor, which ran for a total of 274 hr at speeds above 500 rpm. Shaft power to the compressor achieved values above 10 hp; shaft power from the expander exceeded 0.9 hp. Efficiency of the expander approached 40%. There were some difficulties with materials. Platinum tubing and thermocouples melted after alloying with silicon. The commercial graphite cement used behaved poorly, although the tests were not critically dependent on the joints. A review of the dependence of the strength of graphite on temperature reveals that the conditions of these tests reveal in small measure the potentialities of graphite. Author (NSA)

N66-27458# Rocky Flats Div., Dow Chemical Co., Golden, Colo.
OPTICAL DETERMINATION OF DEPTH OF DEFECTS BY REPLICATION TECHNIQUES
D. V. Miley and V. K. Grotzky 14 Jan. 1966 7 p
(Contract AT(29-1)-1106)
(RFP-673) CFSTI: HC $1.00/MF $0.50

Replication of defects was accomplished by a variety of techniques and produced accurate depth determinations. Of the replicating materials tested, General Electric RTV20 was most suitable for this application. A microscope is required for depth determinations on replicated surface defects. Basically, this should be a binocular unit employing vertical illumination, with a fine focus mechanism graduated in microns. Examination is best accomplished at magnifications of 150-200X. Author (NSA)

N66-27598# Army Foreign Science and Technology Center, Washington, D. C.
EXPERIMENTAL STUDY OF THE EFFECT OF VIBRATIONS ON FRICTION IN THE CYLINDRICAL GUIDE-BEARINGS FOR A BALANCE-WHEEL SPINDLE
A. P. Isayev Mar. 1966 16 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Priborostr. (Leningrad), no. 4, Jul.-Aug. 1961 p 101-108
(FSTC-HT-23-40-66; AD-630853) CFSTI: HC $1.00/MF $0.50

The article presents the results of an experimental study pertaining to the effect of vibration on the friction torque in balance-wheel spindles and bearings of chronometers in general but 'Pobeda' and aviation instruments in particular. The effect of rotational speed and radial clearance between spindle journal and bearing bore, also the effect of the magnitude of a vibrational overload were tested. The significance of the position of the spindle relative to the earth's gravitational field is discussed. It is shown that the frictional torque can be made constant regardless of the angle of inclination of the spindle. The mutual relation between frictional torque and impact torque due to vibration is analyzed, and it is explained why, at vibrational overloads larger than 1 g, the impact torque becomes equal to zero. The impact torque refers to the spindle journal striking the inner bearing surface, while between strikes the spindle is in a suspended position. Author (TAB)

N66-27627# Aeroprojects, Inc., West Chester, Pa.
ULTRASONIC WELDING PROCESS AND EQUIPMENT FOR CONSTRUCTION OF ELECTRON-TUBE MOUNTS Quarterly Progress Report, Jul. 1–Sep. 30, 1965
G. S. Thomas [1965] 22 p
(Contract DA-36-039-SC-86741)
(QPR-13; AD-631489) CFSTI: HC $1.00/MF $0.50

Fabrication of the sample lot of 100 type 6080WB electron tubes was completed up to the last step in the assembly sequence. The last step could not be carried out because of a part change made by Tung-Sol since this effort was initiated. A method of adapting equipment and procedures to the current production part is being sought. Electrical tests showed that most of the tubes in the sample lot had short circuits. The cause was found to be incorrect assembly prior to welding, not faulty welded joints. Appropriately modified inspection procedures will be used in fabricating a second sample lot. Components welding was completed. Welding of 0.003-inch tungsten–rhenium (W-3Re) wire was carried out with a 300-watt welder. Bond strengths of wires welded to nickel and molybdenum sheets were significantly less than the satisfactory strengths obtained previously with a 600-watt welder. Wires could be welded to tungsten sheet with the 300-watt welder, and average tensile-shear strength of the bonds was 26 percent of the wire strength. Frame grid welding was carried out with a 4-kw welder in an attempt to weld all wire turns on one side rod simultaneously. Satisfactory bonding of all wires was not achieved with this approach, and further effort in this direction was discontinued. Author (TAB)

N66-27674# Bergen Research Engineering Corp., Teterboro, N. J.
EVALUATION STUDY OF BALANCED LOAD PLANETARY TRANSMISSION AND DESIGN OF 250-HORSEPOWER UNIT WITH 4000-HOUR TIME BETWEEN OVERHAUL (TBO) Final Report
Stanley W. Baker, Charles S. Davis, Jr., and William H. Schwab
Jan. 1966 60 p refs *Its* Rept.-3314-R3
(Contract DA-44-177-AMC-102(T))
(USAAVLABS-TR-64-30; AD-631466) CFSTI: HC $3.00/MF $0.75

This report presents a complete review of the parametric design and computer at dies performed to evaluate the Bergen Research Compound Planetary Transmission concept in three configurations for a helicopter transmission. All three concepts embody design arrangements which assure uniform load division with multiple compound planetary gears. Uniform loading is accomplished by balancing the primary and secondary meshing point positions through low rate springing. These systems stabilize at the gear mesh positions of load path equalization. Design are established for typical power ranges using consistent gear and bearing design factors. Both 1000 and 4000 hour time before overhaul design factors are studied to determine their feasibility and design trade off requirements. The Phase I study results are applied in Phase II to the preferred design concept through completion of a specific layout and detail design. This 250 horsepower/4000 hour, design is suitable for fabrication and life testing. Author (TAB)

N66-27676# Rensselaer Polytechnic Inst., Troy, N. Y.
SURFACE TEMPERATURES AT SLIDING INTERFACES IN VACUA AND METAL ADHESION Technical Documentary Report, 15 Nov. 1963–15 Feb. 1964
F. F. Ling Wright-Patterson AFB, Ohio, AF Mater. Lab., Mar. 1964 58 p refs
(Contract AF 33(657)-10058)
(ML-TDR-64-97; AD-631342) CFSTI: HC $3.00/MF $0.50

A friction and wear apparatus is described for use in vacua which has no supporting bearings other than the sliding surfaces whose friction and wear characteristics are to be investigated. The moving specimen is suspended and rotated magnetically, external to a vacuum chamber enclosing the test section. Typical temperature, friction and wear data are shown. Moreover, a mechanism of metal adhesion is postulated and a formula on the coefficient of adhesion derived. The experimental equipment to confirm the validity of the theory, at least phenomenologically, is described. The experimental equipment permits loading of predetermined amounts under varied temperatures and durations in vacua; the force of separation is then measured. The simple theory indicates the parameters of the problem: contact load, duration of loading, temperature at the interface, and cleanliness of the interface. The last item is measured through two quantities: (a) a reduced activation energy; and (b) a reduced time exponent of the process. The relationship between adhesion and friction is discussed. Author (TAB)

N66-27723# Army Missile Command, Huntsville, Ala. Translation Branch.
SOME PROBLEMS OF THE WELDING OF TITANIUM AND ITS ALLOYS BY MELTING
G. L. Petrov, M. D. Shchipkov, A. I. Lebedev, and A. S. Yazykov
24 Feb. 1966 18 p refs Transl. into ENGLISH from the Publ. "Titanium Metal Studies" Moscow, Izd. Nauka, 1964 p 273–282
(RSIC-525; AD-631213) CFSTI: HC $1.00/MF $0.50

An investigation was conducted of the sources of saturation of the seam metal with oxygen and hydrogen during the welding of titanium, the possible redistribution of these gases at the interface of the regions of alpha and beta titanium under the conditions of the welding cycle, and the residual deformations during argon arc welding of titanium alloys. Author

N66-27757*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VACUUM UV COATINGS, MICROCIRCUITRY WELDING, METAL POLISHING STUDY, ABSOLUTE SPECTRAL RESPONSE SYSTEM, PARABOLIC REFLECTORS, SOLDERING TO ELECTRODEPOSITED METALS Quarterly Progress Report, Jan. 1–Mar. 31, 1966
M. Levinsohn [1966] 24 p refs
(NASA-TM-X-57614) CFSTI: HC $1.00/MF $0.50 CSCL 13H

This report describes progress on a series of experimental fabrication and engineering projects. This period's activities include an investigation of a procedure for depositing uniform

vacuum ultraviolet reflecting coatings on large surfaces; installation and testing of a device to measure electrode tip movement during a microcircuitry welding cycle; results of a metal polishing study to determine the suitability of nickel, beryllium, Haynes 25, Lurium 5, and aluminum 2024 and 6061 as reflective optical elements; testing of a high intensity light source optical system; further development of an explosive forming technique for fabricating parabolic reflectors; and tests to determine the suitability of electroplated gold as a base for soldering. R.N.A.

N66-27834# Office of Naval Intelligence, Washington, D. C. Translation Section.
EXPERIMENTAL DETERMINATION OF STRESSES IN FREE-WHEELING ROLLER MECHANISMS
V. F. Maltsev [1966] 13 p refs Transl. into ENGLISH from Herald of Mech. Eng. (USSR), 1961 p 39–43
(ONI-TRANS-901; AD-630740)

A method is described for determining the stresses in free wheeling roller mechanisms, in particular, the stresses of the contact surface of the roller with the rings during wedging. Tests were conducted to determine the rated loads of the contact surface of the roller with the star wheel for static loading. Results are presented graphically and show the irregular load distribution among the rollers during loading. The variation curves of the rated load, determined experimentally, show that with an increase of load, the increase of the rated load is slowed down somewhat. This is explained by the wedging angle effect on the rated load which is increased with an increase of torque. A good agreement can be seen between the calculated rated load curve and the experimental curves. The difference between these values increases with a reduction of the wedging angle and the number of rollers, and an increase of load. The formula used to calculate the rated loads gives excessive results. A coefficient, which considers the nonuniformity of the loading among the rollers, should be determined as a ratio of the magnitude of the calculated rated load at the contact surface of the roller and star wheel to the maximum value of this load, obtained experimentally. R.N.A.

N66-27931*# SKF Industries, Inc., King of Prussia, Pa. Research Lab.
BEARING-LUBRICANT ENDURANCE CHARACTERISTICS AT HIGH SPEEDS AND HIGH TEMPERATURES Final Report, Sep. 1–Aug. 31, 1965
C. J. Wachendorfer and L. B. Sibley [1965] 129 p refs
(Contract NASw-492)
(NASA-CR-75582; AL65T068) CFSTI: HC $4.00/MF $1.00 CSCL 11H

This study was performed to determine operability, critical mode of failure and life of angular-contact ball bearings of advanced design at high temperatures in excess of 500°F using the best available fluid lubricants in a recirculating system. 205-size 25mm-bore angular-contact ball bearings made of vacuum-melted tool steels having high hot hardness were tested with a number of high-temperature fluid lubricants representing hydrocarbons, esters, and polyphenyl ethers. The test machine was designed to simulate a typical aerospace accessory drive system with nitrogen blanketing to minimize lubricant oxidation at high temperature. Bearing design parameters and cage materials were developed for successful operation under the test conditions. Results were obtained from over 300 bearings tested with 17 different lubricants at high load (300 to 500 lbs. thrust) and speeds from 20,000 to 45,000 rpm. These results indicate that satisfactory operation is possible at bearing temperatures at least up to 600°F. Author

N66-27932*# Mechanical Technology, Inc., Latham, N. Y.
ANALYSIS AND DESIGN DATA FOR THE AXIAL-EXCURSION TRANSDUCER OF SQUEEZE-FILM BEARINGS
T. Chiang and C. H. T. Pan 2 Jun. 1965 46 p refs
(Contract NAS8-11678)
(NASA-CR-75619; MTI-65TR25) CFSTI: HC $2.00/MF $0.50 CSCL 13I

Longitudinal resonant modes of typical transducer configurations applicable to squeeze-film bearings are analyzed. The transducer consists of a driving section and a driven extension on which the squeeze-film bearing is mounted. The extended section of the transducer is designed to provide amplification of excursions of the driving section. Three preliminary design configurations are proposed in this report. Both a general analysis and a simplified approach are presented; design data are provided for each design configuration. Author

N66-28033*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
STATUS OF LUBRICANTS FOR MANNED SPACECRAFT
Frans G. A. de Laat (TRW Systems, Redondo Beach, Calif.), R. V. Shelton (N. Am. Aviation, Downey, Calif.), and J. H. Kimzey Jun. 1966 26 p refs Presented at the 21st Ann. Meeting of the Am. Soc. of Lubrication Engr., Pittsburgh, 2 May 1966
(NASA-TM-X-58002) CFSTI: HC $2.00/MF $0.50 CSCL 11H

This paper reports the status of lubricants selected for use on manned spacecraft such as Apollo. The selection of lubricants was based on four major test programs: lubricant compatibility with oxygen-rich environment for crew-compartment toxicity-order hazard evaluations; lubricant-propellant compatibility investigations for long-exposure endurance; solid-dry-film lubricant compatibility with various anodic coatings; and studies of lubricant sliding-friction behavior in vacuums such as are encountered in space. These tests resulted in the selection of several solid-dry-film lubricants, such as a completely inorganic, electrophoretic, bonded material containing molybdenum disulfide, graphite, and lead sulfide as the major lubricity. Among the greases, a completely polymeric perfluorinated material with a fluorocarbon-telomer thickener showed an unsurpassed compatibility with propellants and, in the oxygen-compatibility tests, a remarkable inertness. Author

N66-28040*# Aerojet-General Corp., Azusa, Calif. Von Karman Center.
IMPROVED CRYOGENIC RESIN/GLASS-FILAMENT-WOUND COMPOSITES Interim Report, 29 Jun. 1965–28 Mar. 1966
A. Lewis, G. E. Bush, and J. Creedon May 1966 84 p refs
(Contract NAS3-6297)
(NASA-CR-54867; Aerojet-3196) CFSTI: HC $3.00/MF $0.75 CSCL 11D

The use of NOL rings fabricated from monofilaments of Aerojet Hi-Stren glass drawn directly from the bushing provided an efficient and economical technique for interlaminar-shear testing. Specimens cut from the rings were tested at room temperature, after 6 hours in boiling water, and at −423°F to evaluate finish compositions, matrix resins, and flexibilizers for cryogenic application. The coupling agents used in the finish improved wet-strength retention more than the room-temperature or cryogenic shear strengths. Author

N66-28042*# Research Triangle Inst., Durham, N. C.
DEVELOPMENT OF RELIABILITY METHODOLOGY FOR SYSTEMS ENGINEERING. VOLUME I: METHODOLOGY—ANALYSIS TECHNIQUES AND PROCEDURES Final Report

A. C. Nelson, C. A. Krohn, and W. S. Thompson Apr. 1966 68 p refs
(Contract NASw-905)
(NASA-CR-75670) CFSTI: HC $3.00/MF $0.75 CSCL 14D

This volume describes reliability analyses for equipment in the design stage. The major, essential reliability tasks are failure modes and effects analyses, performance variation analyses, component stress analyses, and reliability prediction. The proper coordinated use of these provides the bases for evaluating and improving the design to achieve the earliest possible assurance for reliability. Analysis of the ways in which components fail and the effects of each mode helps to determine the criticality of each component and assists in focusing appropriate emphasis in other efforts. Comparison of operating stresses of components to ratings determines whether components are being properly applied. For performance variation, either an equation for performance is necessary or else a physical model is used for direct observation and evaluation. The relative contribution of each component to the overall variability can be assessed. Probabilistic techniques such as Monte Carlo simulation and propagation of moments can be used to estimate the probabilities or distributions of performance. Author

N66-28083# Joint Publications Research Service, Washington, D. C.
EXPLOSION ENERGY AND CHARGE DESIGN
N. V. Mel'nikov and L. N. Marchenko 9 Jun. 1966 149 p refs
Transl. into ENGLISH of the book "Energiya Vzryva i Konstruktsiya Zaryada" Moscow, Nedra, 1964 p 3-138
(JPRS-35928; TT-66-32362) CFSTI: $4.00

In order to facilitate the performance of cyclic and continuously operating machines suitable for a flow line mining operation, blasting methods which are capable of breaking up a mass of material into fairly small lumps of uniform size were sought. It was both theoretically and empirically established that by reducing the peak pressure and temperature and by prolonging the duration of the explosion process the effects of any given explosion may be more uniformly and more widely distributed. The prolongation and the reduction can be achieved rather simply by decreasing the density of the explosive, the introduction of air to decrease the density of the explosive material. It was found that this air gap method, along with the proper timing and placement of different strength charges in different media, results in a uniformly broken mass of material. D.T.

N66-28106# Space-General Corp., El Monte, Calif.
NEW MATERIALS AND FABRICATION TECHNOLOGIES FOR A SPACE RESCUE VEHICLE
J. F. Keville [1966] 33 p Presented at the Am. Soc. of Mech. Engr. San Diego Sect. Meeting, 17 Feb. 1966 Sponsored by AF
(PRA-85)

This report discusses the development of high strength, high temperature expandable structures which can be stored in a small volume aboard a space station, inflated and used for returning a man safely to earth in event of an emergency. The vehicle proposed for this mission is an inflated paraglider, about 23 feet long, which is constructed of a special, newly developed nickel chromium metal fabric impregnated and coated with two types of high temperature resistant silicone rubber. The final technological breakthrough which permitted construction of such a vehicle was the development of a special deep throat, semi-automatic spot welder for making joints in the metal fabric. Up to five layers of metal fabric can be welded together with flexible seams 85% as strong as the parent fabric. The entire fabrication process including manufacture of the ultra-fine filament metal fabric, lay-up and welding of shapes with compound curvature, and impregnation and coating will be described and illustrated with slides. Tests performed to date, indicate that the design goals have been exceeded. Author

N66-28246# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE CHANGE OF PROPERTIES OF DISPERSION MEDIA OF PLASTIC LUBRICANTS UNDER THE EFFECT OF RADIATION
Ye. D. Makeyeva, L. A. Kumleva et al 23 Mar. 1966 9 p refs
Transl. into ENGLISH from Khim. i Tekhnol. Topliv i Masel (Moscow), no. 9, 1964 p 38-40
(FTD-TT-65-1731/1+4; AD-631448) CFSTI: HC $1.00/MF $0.50

The change in properties of a series of oils, used in role of dispersion media of plastic lubrications, under the effect of gamma-radiation was investigated. The anti-radiation properties on these oils of admixture of two types were determined: binding free radicals (e.g. dialkylselenides) and absorbing radiation energy on account of resonance adsorption in the molecules of condensed aromatic compounds (for example, acenaphthene). TAB

N66-28360# Argonne National Lab., Ill. Metallurgy Div.
VIBRATORY GRINDING AND POLISHING OF METALLOGRAPHIC SPECIMENS
S. Matras Nov. 1965 37 p refs
(Contract W-31-109-ENG-38)
(ANL-6975) CFSTI: HC $2.00/MF $0.50

The range of metallographic specimen preparation by vibratory polishing was extended to include the grinding operation. A controlled method was developed that reduces the metallographic grinding operation to essentially one step. This was achieved by: controlling the horizontal and vertical components of vibration by changing the springs and the weight of the bowl of the apparatus to conform to the specific requirements of grinding, and providing a special fixture that guides the specimen in a controlled and predetermined manner. The grinding fixture consists of a Lucite bowl that holds an 8-in.-dia. silicon carbide paper disc and a rotating turret in which the specimens are spaced and loaded with appropriate weights. The grinding produces specimens whose surfaces possess a minimum of distrubed metal with virtually no embedded abrasive. The specimens have flat surfaces and their edges are well-preserved. Inclusions and second phases, not normally in evidence at this stage of specimen preparation, are clearly delineated in the matrix. Retention of hard inclusions in a soft matrix is excellent. To achieve satisfactory surfaces, a final-polishing fixture utilizing a centermounted, rotating carrier was devised. This fixture replaces the standard, stainless steel, polishing bowl and retaining ring. The fixture is mounted on a standard vibratory polishing unit. In contrast to standard vibratory polishing units that require specimen loadings of 300 to 600 g, the new device may be operated without any load on the specimen and will produce a superior polish. Preparing metallographic specimens now involves only three steps: specimen grinding on 400- or 600-grit silicon carbide paper, intermediate polishing, and final polishing. No more hand operations are necessary. The method has broad applicability. For example, it is routinely used for the specimen preparation of cermets, and high-purity thorium and thorium-plutonium alloys have also been successfully prepared. The technique is presently adapted to glovebox work for plutonium and its alloys, diffusion couples and alloys, and cermets that are difficult to prepare. Author (NSA)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N66-27887# International Business Machines Corp., Yorktown Heights, N. Y. Thomas J. Watson Research Center.
INJECTION LASER STUDY Final Technical Report, 1 Jun. 1963-31 May 1965
K. Konnerth, F. F. Morehead, F. Stern, P. R. Wagner, and K. Weiser [1965] 79 p refs
(Contract DA-36-039-AMC-02349(E))
(Rept.-8; AD-631499) CFSTI: HC $3.00/MF $0.75

Many GaAs injection laser diodes show a substantial delay between the application of a current pulse and the onset of lasing if they are operated near room temperature and at currents just above threshold. A model for this effect based on trapping of carriers gives good agreement both with the delay results and with experimental data on the time dependence of spontaneous emission for currents below threshold, provided that the density of trapping states is about ten times the threshold carrier concentration. No independent evidence for the existence of these states has been obtained. The dependence of current and light emission on voltage in CdTe diodes was studied. The current varies as exp (qV/2kT) at low current levels, and as exp (qV/kT) at higher current levels. Emission is observed with photon energies considerably greater than the applied voltage. Thermodynamic considerations restrict the efficiency of such radiation from one-step processes, and account in part for the low quantum efficiency found at room temperature. In GaAs structures with a high-resistance p-type layer surrounded by high-conductivity p-type layers, ambipolar negative resistance, efficient light emission, and lasing were observed. The origin of the electrons is thought to be avalanching in the strong electric field found to present in these all p-type structures. TAB

N66-27790# California Univ., La Jolla. Visibility Lab.
UNDERWATER OPTICS
S. Q. Duntley 12 Mar. 1966 25 p
(Contract Nonr-2216(14))
(AD-631033) CFSTI: HC $1.00/MF $0.50

Data taken in 1965 confirm previous measurements made with a conventional light source in 1962 and with a laser source in 1964. The data continue to indicate a difference in the propagation characteristics of the two sources. This difference is ascribed to the different beam geometries, but it disappears when an integrating sphere with a 4-inch aperture is used for a receiver and a beam compression device is employed. Thus the laser and conventional sources have similar gross propagation properties although the data still indicate the presence of scattering effects. Thus the range of underwater laser devices may be longer than anticipated. The data also indicate that appreciable portions of the irradiance is far from the axis. Author (TAB)

N66-27815# American Optical Co., Southbridge, Mass. Research Div.
OPTICAL INHOMOGENEITIES IN PUMPED LASERS Semiannual Technical Report Number One, 22 Jun.-31 Dec. 1965
Charles J. Koester Mar. 1966 44 p refs
(Contract Nonr-4875(00); ARPA Order 306; Project Defender)
(RD-601-580; AD-630933) CFSTI: HC $4.60/MF $0.50

This report delineates progress made during the analysis in depth of thermal distortion of wavefronts in large laser rods. Included is an Introduction and Summary which briefly describes the problem, the program, results to date and future direction of effort. A review of previous work by American Optical Company and others is given. In separate sections, Thermally Stable Cavities, Temperature Profiles and Index Changes are treated. Finally a mathematical study of End Region Stress Analysis is presented. Author (TAB)

N66-27897# Massachusetts Inst. of Tech., Cambridge.
STUDY OF VARIOUS ASPECTS OF RAMAN SCATTERING USING C.W. OPTICAL MASERS Semiannual Technical Summary Report No. 1, Aug. 1, 1965-Feb. 1, 1966
A. Javan 25 Mar. 1966 9 p refs
(Contract Nonr-3963(22); ARPA Order 306; Proj. Defender)
(MIT-DSR-4979; AD-631039) CFSTI: HC $1.00/MF $0.50

Contents: Linewidth of Raman scattering, by J. R. Murray, A. P. Sheng, J. D. Ducuing; Stimulated Raman absorption in liquids, by t J. R. Murray, A. P. Sheng, J. D. Ducuing; Two photon absorption processes, by J. R. Murray, A. P. Sheng, A. Javan; Ramam scattering in gases-linewidth phenomena by J. R. Murray, A. P. Sheng, A. Javan. TAB

N66-27953*# Sylvania Electric Products, Inc., Mountain View, Calif. Electronic Defense Labs.
STUDY OF VIBRATION MEASUREMENT BY LASER METHODS
Gail A. Massey [1966] 68 p refs
(Contract NAS2-3137)
(NASA-CR-75643) CFSTI: HC $3.00/MF $0.75 CSCL 20E

A four-month study of laser techniques for detecting and measuring vibrations of a spacecraft model on a shake table has been conducted. An interference mapping technique, similar to holography in some respects, was developed. It appears that the coherent detection systems may be useful in measuring vibrations down to one micron peak amplitude or perhaps less, even on diffusely reflecting surfaces. The microwave systems provide the poorest sensitivity. The interference mapping system gives a visual indication of surface tilt or gradient of normal displacement, and thus can provide a useful map of positions of maximum and minimum displacement. Most of the systems were tested experimentally; results were generally in good agreement with the analysis. This report contains a detailed description of each approach, a comparison of the relative performances of the various systems, and recommendations for further investigation and development of the most promising techniques. Author

N66-28336# Institut für Plasmaphysik G.m.b.H., Garching (West Germany).
A GIANT PULSE LASER WITH A TRIGGERABLE PASSIVE Q-SWITCH PERFORMANCE
K. Maischberger May 1966 20 p refs Presented at the 4th Symp. on Eng. Probl. in Thermonuclear Res., Frascati, Italy, 23-27 May 1966
(IPP-4/34) CFSTI: HC $1.00/MF $0.50

A method of ruby laser operation is described which produces fast, intense, and triggerable giant laser pulses by Q-switching with a selective saturable organic dye. The ruby rod 5/8 in. in diameter and 7 in. long is used in an ellipsoid pump configuration. The passive Q-switch element is placed between the 90° rod with a TIR chisel and a separate end mirror. A double-pulse circuit energizes a linear flash tube. A preionizing pulse fires the main capacitor bank. After a suitable delay a second trigger signal switches the energy of a capacitor to the flash tube load. This short high-power pulse, now not current limited, will start laser action corresponding to the

second trigger signal on conditions which will be discussed. The jitter relative to the second trigger signal, the energy and power output of the resulting giant pulses is reported. Author

N66-28382*# Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
LASIG II: PULSED LASER ION GENERATOR STUDY Final Report
R. E. Biss and A. S. Gilmour, Jr. 5 Oct. 1965 173 p refs
(Contract NAS3-5919)
(NASA-CR-54154; CAL-UB-1989-E-4) CFSTI: HC $5.00/MF $1.00 CSCL 20E

Thirteen materials were illuminated in vacuum with the focused output of a pulsed ruby laser. Illumination of materials such as chromium, columbium, tantalum, thorium, tungsten and zirconium resulted in the emission of ion currents of 3 to 4 amperes. Thrusts from this laser-induced emission have been measured at over 4 millipounds. An average ion energy of 40 electron volts, with a specific impulse of 660 seconds has been obtained. Measurements were made on the density and energy distribution of the emitted ions. Author

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N66-28916# Michigan Univ., Ann Arbor. Dept. of Nuclear Engineering.
ULTRASONIC-INDUCED CAVITATION STUDIES IN LEAD-BISMUTH ALLOY AT ELEVATED TEMPERATURES
R. Garcia and F. G. Hammitt Sep. 1965 41 p refs
(Grant NSF G-22529)
(Rept.-05031-4-I)

Two stainless steels, two tantalum alloys, Mo–1/2Ti, and Nb–1Zr were subjected to a cavitation environment in a 70% lead–30% bismuth alloy at 500 and 1500°F with a vibratory device utilizing a piezoelectric crystal transducer unit and a high-temperature cavitation facility. At the lower temperature, the Ta alloys were the most cavitation-resistant based on mean depth of penetration, although Mo–1/2Ti and the stainless steels were almost as good; at the higher temperature, the Ta alloys were best and annealed Nb–1Zr and one stainless steel were least resistant. Cavitation damage was significantly greater at the higher temperature for all the materials. Correlations between cavitation damage data and the mechanical properties of the various materials are presented. M.W.R.

N66-26947# Joint Publications Research Service, Washington, D. C.
SOVIET RESEARCH ON TITANIUM ALLOYS
10 May 1966 36 p refs Transl. into ENGLISH from Russian (JPRS-35419; TT-66-31855) CFSTI: $2.00

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N66-26948# Joint Publications Research Service, Washington, D. C.
HIGH-STRENGTH TITANIUM ALLOYS
V. N. Moiseyev, S. G. Glazunov, and B. M. Mikhaylov *In its* Soviet Res. on Titanium Alloys 10 May 1966 p 1–5 Transl. into ENGLISH from Tsvetn. Metally (Moscow), no. 2, Feb. 1966 p 80–82 (See N66-22947 15-17) CFSTI: $2.00

Hardening and aging treatments for obtaining high strength α and β structure titanium alloys are discussed, and details are given on the development of a Ti–Mo high strength alloy. Binary and ternary alloys containing up to 30% Mo and 6% Al were studied. The heat treatment consisted of hardening in water at temperatures of 750°, 800°, and 850°C, after holding at the corresponding temperature for 15 minutes, and subsequent aging at 450° to 500°C for 4 to 16 hours. Maximum strength was observed in alloys containing 8 to 10% Mo, or close to the critical composition where the martensite transformation temperature is near to room temperature. It was also found that the addition of aluminum to the Ti–Mo alloys resulted in increased strength both in the annealed and heat treated states. Studies were conducted on Ti–Mo systems with additives of aluminum, iron, chromium, and vanadium in amounts close to the critical composition. An analysis of the mechanical properties shows that alloys close to critical composition, with α and β phases containing several alloying components, may be strengthened to a very high level by hardening and aging. M.G.J.

N66-26949# Joint Publications Research Service, Washington, D. C.
COLD DEFORMATION AND ANNEALING OF VT 15 ALLOY
N. S. Alferova, R. I. Shevchenko, and T. V. Kutsygina *In its* Soviet Res. on Titanium Alloys 10 May 1966 p 6–8 refs Transl. into ENGLISH from Metalloved. i Term. Obrabotka Metallov (Moscow), no. 2, Feb. 1966 p 50–51 (See N66-26947 15-17) CFSTI: $2.00

The capacity of the VT 15 alloy for cold deformation during longitudinal rolling was investigated, together with the influence of the annealing temperature on the structure and hardness of the cold-deformed metal. The alloy (3% Al, 6.5% Mo, and 10.7% Cr) was prepared by vacuum melting, then subjected to forging and hot rolling. Test details are given, along with the mechanical properties of the alloy after hardening. In a comparison with a stainless steel specimen, it was shown that the capacity of the alloy for being strengthened is considerably less than that of the steel. It was also found: (1) Annealing at 400°C causes no change in hardness; an increase to 500° to 600°C causes a sharp increase in hardness conditioned by the intense decomposition of the metastable β phase. (2) An increase in the hardness maxima occurs with an increase in the degree of preliminary deformation. M.G.J.

N66-26950# Joint Publications Research Service, Washington, D. C.

PROTECTION OF TITANIUM ALLOYS FROM OXIDATION

V. N. Brinza and V. S. Lepekin *In its* Soviet Res. on Titanium Alloys 10 May 1966 p 9-11 refs Transl. into ENGLISH from Tsvetn. Metally (Moscow), no. 12, Dec. 1965 p 77-79 (See N66-26947 15-17) CFSTI: $2.00

Various coatings for titanium alloys are discussed in relation to the necessity for protecting the alloys from oxidation and the absorption of gases during heat processing under pressure. As studies show that weight losses were from 5 to 9% in testpieces treated with a coating containing up to 60% SiO_2, an increased content of free SiO_2 is considered undesirable. A formula is proposed, consisting of 31 to 35% fine ground talc; 16 to 18% rutile dust; 8 to 10% borax; 12 to 14% Na_2CO_3; 0.3% K_2CO_3; 17% fine ground kaolin; and 28 to 30% H_2O. Experiments were conducted at 900° to 1200°C for three hours, and treated and untreated test pieces were compared. Results show that the treated pieces had lower weight losses; a 15 to 20% increase in hardness; clean surfaces; and a homogeneous surface microstructure. M.G.J.

N66-26951# Joint Publications Research Service, Washington, D. C.

CLADDING TITANIUM IN A VACUUM

R. A. Ul'yanov and S. F. Kovtun *In its* Soviet Res. on Titanium Alloys 10 May 1966 p 12-15 refs Transl. into ENGLISH from Tsvetn. Metally (Moscow), no. 12, Dec. 1965 p 79-82 (See N66-26947 15-17) CFSTI: $2.00

Niobium, molybdenum, tantalum, and tungsten were investigated for use as protective coatings on titanium alloys. The relative adhesion strengths of the various coatings with the substrate were determined, as were the effects of prolonged heating on the contact zone structure. The cladding was performed by bulk rolling from 1100° to 1200°C at a pressure of 10^{-5} mm Hg. The ingots were rolled wedge shaped in order to facilitate the study of adhesion strength dependence on the degree of reduction. The highest strength, with reduction up to 50%, was achieved between titanium and tantalum; the lowest, between titanium and molybdenum. Since the chemical interaction is identical in each case, the difference in strength was attributed to the different moduli of plasticity for tantalum and molybdenum at the rolling temperatures. It was also found that prolonged heating causes a deepening of diffusion in the contact zone, but that this does not embrittle the joint. D.T.

N66-26952# Joint Publications Research Service, Washington, D. C.

SULFURIC ACID PICKLING OF TITANIUM ALLOYS

S. A. Kushakevich and Z. K. Khanina *In its* Soviet Res. on Titanium Alloys 10 May 1966 p 16-21 Transl. into ENGLISH from Tsvetn. Metally (Moscow), no. 12, Dec. 1965 p 86-89 (See N66-26947 15-17) CFSTI: $2.00

Several solutions were tested for the removal of oxide scale from sheets of annealed titanium alloy. The test solutions were 6% HCl+4% NaF, 20% H_2SO_4+ 4% NH_4F, and 20% H_2SO_4 +4% HF. It was found that the best pickling solution for titanium alloys was 20% H_2SO_4+NH_4F. D.T.

N66-26953# Joint Publications Research Service, Washington, D. C.

INCREASING THE FATIGUE STRENGTH OF SPOT-WELDED ALUMINUM AND TITANIUM ALLOY JOINTS

V. M. Sagalevich and B. B. Zolotarev *In its* Soviet Res. on Titanium Alloys 10 May 1966 p 22-29 refs Transl. into ENGLISH from Tsvetn. Metally (Moscow), no. 11, Nov. 1965 p 108-111 (See N66-26947 15-17) CFSTI: $2.00

Methods and procedures were investigated for reducing the residual stress about spot welds joining thin materials, and consequently, increasing the tensile strength of the joint. Experiments were conducted to determine the effects of varying the basic weld parameters, i.e., welding current, pulse length, and electrode compression force. The results, however, were disappointing. Therefore, the influence of additional parameters was studied. It was found that residual stress was most effectively reduced by a sudden increase of electrode compression following completion of the current pulse. Three parameters were introduced by this method: (1) the length of time following completion of the pulse; (2) magnitude of increase in compression; and (3) the shape of the electrode. Fatigue tests showed that the best results for materials from six to eight mm thick were obtained with a delay of approximately 0.06 seconds following the current pulse, an increase of compression by a factor of 3.5 to 4, and a spherically tipped electrode. In addition, it was suggested that cycling the current pulses and the hammering might lead to even stronger joints. D.T.

N66-27010# Naval Research Lab., Washington, D. C.

A RATE "SPECTRUM" OF STRAIN HARDENABILITY AND OF FRACTURE TOUGHNESS

J. M. Krafft *In its* Rept. of NRL Progr. Jan. 1966 p 6-16 refs (See N66-27008 15-15)

A more critical comparison of the plane strain fracture toughness K_{Ic} with the strain hardening coefficient n has resolved a characteristic strain rate dependency for a mild steel pipeline material. As before, an invariant proportionality between K_{Ic} and n and their time derivatives was observed. For a true stress $\bar{\sigma}$ *versus* strain ϵ curve at a given strain ϵ, $n=\epsilon\bar{\theta}/\bar{\sigma}$, where $\bar{\theta}$ is the absolute rate of work hardening, $d\bar{\sigma}/d\epsilon$. As expected for this body centered cubic metal, σ varied smoothly with temperature and strain rate, and $\bar{\theta}$ was insensitive to temperature. Unexpectedly, however, $\bar{\theta}$ was found markedly sensitive to the rate of straining. Troughs in $\bar{\theta}$ values, some reducing the level by one half, were found at well-defined strain rates of 3.5×10^{-4}, 4.2×10^{-3}, 3.5×10^{-1}, 2.5, and 35 sec^{-1}. At simple multiples and submultiples, harmonic-like images were observed. The troughs are thought to be associated with resonant interactions between moving dislocations and the crystal lattice. Results suggest that the density of mobile dislocations is insensitive to strain but increases slightly with strain rate. The identification of these troughs and their corresponding large deterioration of fracture toughness and general ductility is thought to have important practical applications. Author

N66-27017# Manlabs, Inc., Cambridge, Mass.

THERMOMECHANICAL TREATMENTS APPLIED TO ULTRA-HIGH STRENGTH STEELS Quarterly Report, Oct. 28, 1965-Jan. 31, 1966

D. Kalish and S. A. Kulin [1966] 50 p refs (Contract NOw-66-0142-c) (QR-1)

The program involving thermomechanical treatments of 9% nickel-4% cobalt steels at two carbon levels (0.25 and 0.45%) is continuing. Data is presented on the effects of variation of pretempering and retempering temperatures in the strain-tempering process. Plain-strain fracture toughness measurements, K_{Ic}, have been obtained as a function of yield strength for conventionally tempered and strain-tempered martensites. It was found that strain-tempering is not detrimental to the fracture toughness (impact energy and K_{Ic}) of martensite when evaluated on the basis of constant yield strength. As

a matter of fact, the yield strength may be improved by strain-tempering above the maximum values obtainable by quenching and tempering without a further decrease in K_{Ic}. It was also found that the fracture toughness, K_{Ic}, of 9-4-45 martensite produced by ausforming is superior to that of conventionally treated martensite at equivalent strength levels. The mechanical properties and tempering characteristics of the 9-4-25 steel have been determined. Correlations are given between strength properties and microstructures. Author

N66-27072*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

OXIDATION AND EMBRITTLEMENT IN SILICIDE-COATED COLUMBIUM-ALLOY AND ALUMINIDE-COATED TANTALUM-ALLOY SHEET

Bland A. Stein and W. Barry Lisagor [1965] 19 p refs Presented at the Met. Soc. of AIME 4th Symp. on Refractory Metals, French Lick, Ind., 3-5 Oct. 1965

(NASA-TM-X-56813) CFSTI: HC $1.00/MF $0.50 CSCL 11F

Results of a study of silicide-coated Cb-10Ti-5Zr columbium-alloy and aluminide-coated Ta-10W tantalum alloy are presented. Data obtained in static and dynamic oxidation tests, mechanical property tests, and metallurgical examinations of small specimens are discussed. For the 0.020-inch-thick columbium-alloy sheet with a chromium-titanium-silicon coating, results indicate that, while useful oxidation lifetimes can be provided to at least 2400°F, permeation of embrittling gases through the coating and rapid diffusion throughout the substrate along grain boundaries during cyclic oxidation tests can cause severe embrittlement of the substrate. For the 0.008-inch-thick tantalum-alloy sheet with an aluminum-tin-molybdenum coating, results indicate that useful oxidation lifetimes and substrate ductility could be retained in static oxidation tests to 2900°F at atmospheric pressure but that coating evaporation could limit its usefulness in low-pressure environments. Dynamic oxidation conditions lowered coating lifetimes considerably. Preliminary results with a new coating of higher molybdenum content indicate longer lifetimes in dynamic oxidation tests. Loss of substrate thickness due to solid-state diffusion during high-temperature exposure is shown to be of considerable magnitude. Author

N66-27077*# American Machine and Foundry Co., Alexandria, Va. Materials Dept.

DEVELOPMENT OF LIGHTWEIGHT MAGNESIUM ALLOYS FOR LOW TEMPERATURE APPLICATIONS Annual Progress Report, 19 Jun. 1964-18 Jun. 1965

H. W. Leavenworth, Jr., H. F. Develin, L. R. Mullen, G. Di Giovanni, F. J. Dunkerley et al 15 Jul. 1965 53 p ref (Contract NAS8-11168)

(NASA-CR-64249) CFSTI: HC $3.00/MF $0.50 CSCL 11F

Forty magnesium alloys were melted and cast in a permanent mold. Of these, nineteen were successfully hot worked and tested at ambient and cryogenic temperatures. The nineteen successful alloys included fourteen modified alloys whose compositions were altered during the course of the program to achieve improved wrought properties. As expected, wide ranges of strength and ductility values were obtained which depended upon the composition of the alloys, the hot working temperature, and the heat treatment. The tensile strength of alloy II-4 (72Mg-1Zr-3Th-7Li-6Zn-5Cd-6Ag) varied from 51,000 psi to approximately 40,000 psi and the percent elongation varied from 11% to 40% at ambient temperature depending upon the wrought structure. The maximum ductility of this alloy at cryogenic temperatures was a respectable 7.8%, but well below the established goals of the program. An elongation of 14% at cryogenic temperatures was obtained for alloy IAB (76.5 Mg-1Zr-3Th-9Li-4Zn-2Al-4Ag-0.5Mn) with a corresponding tensile strength of 41,300 psi and a yield strength of 39,000 psi. The strength and ductility of this alloy are discussed in detail and recommendations for increasing its mechanical properties by variations in melting and casting techniques are presented. Author

N66-27101# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

AN EVALUATION OF THE CORROSION RESISTANCE OF SEVERAL HIGH TEMPERATURE ALLOYS FOR NUCLEAR APPLICATIONS

T. T. Claudson and R. E. Westerman Nov. 1965 32 p refs (Contract AT(45-1)-1830)

(BNWL-155) CFSTI: HC $2.00/MF $0.50

The results showed the comparative oxidation resistance of 10 high-temperature alloys in an oxidizing environment of helium and water vapor. It was found that large weight gains are primarily associated with intergranular corrosion and internal oxidation of the alloy. At 815°C in an atmosphere of low pressure water vapor, Hastelloy C, Hastelloy N, Hastelloy X-280, Inconel 600, Inconel 625, and Haynes 25 have more superior corrosion resistance than the other four materials tested. Weight gains of less than 0.3 mg/cm^2 were observed for these better materials after 300 hr of exposure. Inconel 718, Inconel 702, and Incoloy 800 were more resistant to corrosion than Hastelloy R-235, the least corrosion resistant of all the alloys tested at this temperature. At 930°C, the same relative grouping was found as in the 815°C data. However, more definite evidence of intergranular attack was found in Haynes 25, Inconel 718, and Inconel 600 at 930°C than at the 815°C test temperature. At 1038°C, definite and gross intergranular attack and internal oxidation was found in alloys. Hastelloy C, Hastelloy N, Hastelloy X-280, and Haynes 25 exhibit the best resistance to oxidation, and Inconel 600, Inconel 702, Incoloy 800, and Inconel 625 followed in order. At all test temperatures, Hastelloy R-235 showed the worst attack. Inconel 625 exhibited increasing amounts of grain boundary attack and subsequent internal oxidation with increasing test temperature. NSA

N66-27285# Fabric Research Labs., Inc., Dedham, Mass.

METAL FABRICS FOR AEROSPACE EXPANDABLE STRUCTURES

W. D. Freeston, Jr. *In* AFSC, Wright-Patterson AFB, Ohio Aerospace Expandable Struct. [1966] p 429-446 refs (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

Details are given on the development of flexible, high strength, thermally durable, textile-like fabrics, which are capable of being folded, packaged, and subsequently deployed without being damaged. Candidate materials available in filament form are identified as superalloy and refractory metals, ceramics (oxide fibers, including glass), and carbonaceous residues; superalloy metal filaments are considered suitable for use at 1000°F and above. The technology required to wind and twist fine wire into yarn and weave it into fabric is described. The averages of the warp and filling properties of a series of multifilament yarn, fine wire fabrics are summarized, and compared to equally strong commercial fabric woven from single wires. Results indicate the superior flexibility, crease recovery, fold endurance, and tear strength of the multifilament metallic yarn fabrics. The tensile properties, tear strength, creep, and fold endurance of a multifilament yarn fabric in air at temperatures to 2000°F are given, and methods of joining metal fabric panels by sewing with fine metal filament threads are discussed. M.G.J.

N66-27318*# TRW Equipment Labs., Cleveland, Ohio. Materials Research and Development Dept.

GENERATION OF LONG TIME CREEP DATA OF REFRACTORY ALLOYS AT ELEVATED TEMPERATURES Eleventh Quarterly Report, 26 Dec. 1965–26 Mar. 1966

J. C. Sawyer and E. A. Steigerwals 15 Apr. 1966 94 p refs (Contract NAS3-2545)

(NASA-CR-54973) CFSTI: HC $3.00/MF $0.75 CSCL 11F

To determine their potential suitability for use in advanced power systems, creep tests were conducted on arc-cast and vapor deposited tungsten, the molybdenum base alloys TZC and TZM, columbium modified TZM, and the tantalum base alloys T-111 and T-222. The chemical composition of the alloys, heat treatments, and test procedures are tabulated, and test data are summarized. The creep data are graphically presented as percent total elongation in the two-inch gauge section as a function of time at the applied stress. Reference marks on the curves indicate the chamber pressure during the test period. The program plan involves testing the plate or forged alloys in the 1600° to 2250°F range until a 1% total elongation is obtained; tungsten material in the 2800° to 3200°F range for total extensions of 3 to 5%; and tantalum-base materials in the 1800° to 2200°F range for elongations of approximately 2 to 5%. Data sheets on each test are included.

M.G.J.

N66-27355# California Univ., Berkeley. Lawrence Radiation Lab.

DECOMPOSITION REACTIONS IN GOLD–PLATINUM ALLOYS AND THEIR EFFECTS ON STRENGTH AND FRACTURE CHARACTERISTICS

E. R. Parker, R. W. Carpenter, and V. F. Zackay Oct. 1965 32 p refs Presented at the Intern. Conf. on Fracture, Sendai (Contract W-7405-ENG-48)

(UCRL-16326; CONF-650949-1) CFSTI: HC $2.00/MF $0.50

The effects of spinodal decomposition on the mechanical behavior of alloys was investigated with special reference to gold–platinum alloys. The cause of brittleness and the hardening process were also studied. It was found that the mechanical properties of alloys in which there is a miscibility gap in the alloys system can become very brittle when quenched from the solid solution range, even though the solid solution phases themselves, if tested independently, would be relatively weak but ductile. A grain boundary precipitate of a weak but ductile material was the cause of the brittleness. In analysis of the rapid strain hardening phenomenon, it was concluded that the passage of dislocations in a lattice in which there was a variation in lattice parameter ranging from a maximum to a minimum in a relatively short distance would case very rapid strain hardening to occur.

NSA

N66-27367# United Kingdom Atomic Energy Authority, Risley (England). Reactor Group.

STEELS DATA MANUAL, PROPERTIES OF INTEREST IN REACTOR DESIGN

B. J. Seddon 9 Apr. 1965 218 p

(TRG-840; R-1788) HMSO: 35s

A compilation of the physical, mechanical, chemical, and irradiation properties of several steels of interest in reactor technology, particularly for pressure vessels and canning materials, is presented. These steels include: low-carbon high-manganese steels, low-alloy Cr–Mo steels, 9 Cr–1 Mo steel, 12% Cr steels, and the austenitic stainless steels.

NSA

N66-27388# Brown Univ., Providence, R. I. Div. of Engineering.

A COMBINED MACROSCOPIC AND MICROSCOPIC APPROACH TO THE MECHANICAL PROPERTIES OF METALS Progress Report, Feb. 1965–Jan. 1966

D. C. Drucker and J. Gurland Feb. 1966 9 p refs (Contract AT(30-1)-2394)

(NYO-2394-19) CFSTI: HC $1.00/MF $0.50

A method of sample preparation of the two-phase alloy Al–Si for electron transmission studies was developed and the flow strength and fracture strength as function of particle size and concentration of the two-phase alloys Al–Si and Fe–Fe_3C (spheroidized steel) was determined. A theoretical analysis concerned itself with the role of inclusions as sources of plastic deformation both from the dislocation and continuum points of view. It was shown that the increased resistance to additional slip of particle strengthened metals is due, not to the particle strength itself, but mainly to the expanding network of intersecting slip triggered by the particles. A significant advance was achieved also on the problem of characterizing the long range continuity of a particulate phase randomly distributed. Author (NSA)

N66-27392# Societe d'Etudes, de Recherches et d'Applications pour l'Industrie, Brussels (Belgium).

DYNAMIC CORROSION TESTS ON CARBON AND STAINLESS STEELS IN PRESSURIZED WATER

M. Warzee, P. De Doriodot, and J. Waty 6 Dec. 1965 28 p refs Transl. into ENGLISH from French *Its* Spec. Rept.-4 (Contract EURATOM-089-62-7 RDB)

(EURAEC-1546; EUR-2688) CFSTI: HC $2.00/MF $0.50

Type 304 stainless steel with 0.04% C and Creusot 1.2 MDO7 steel were used as the basic materials for the tests. Four quite different surface treatments were compared: milling, grinding, mechanical polishing up to grade 600, and electrolytic polishing. The research was designed to determine whether the influence of the surface state on corrosion at 300°C, which had appeared under static conditions, persisted under dynamic conditions at flow rates between 2 and 18 m/sec. In the case of AISI 304 steel, it appears that the advantage gained with electrolytic polishing remained, provided the water flow rate did not exceed 5 m/sec. At higher flow rates (10 and 18 m/sec.), a leveling of corrosion results for all surface states appears, together with an appreciable lowering of corrosion at 18 m/sec. As regards Creusot 1.2 MDO7 steel, it is noted that the advantage gained by electrolytic polishing, which appeared under static conditions, disappeared in dynamic tests, even at 2 m/sec. This is undoubtedly due to the intense oxidation–erosion phenomena characterizing the behavior of this type of steel under dynamic conditions. A proportion of 90 to 99% of total erosion is due to the release of oxide to the system, which follows almost linear kinetics at the rate of 150 to 400 mg/dm^2/month, depending on whether the rate is 2 or 10 m/sec. Author (NSA)

N66-27393# California Univ., Berkeley. Lawrence Radiation Lab.

DISLOCATION MECHANISMS IN THE DEFORMATION OF HIGH PURITY TANTALUM AT LOW TEMPERATURES

Sampath Ranji (M.S. Thesis) Jan. 1966 37 p refs (Contract W-7405-ENG-48)

(UCRL-16645) CFSTI: HC $2.00/MF $0.50

The rate controlling mechanism for slip in bcc Ta at low temperatures [$T<0.2\ T_m$] was investigated. High purity single crystals of Ta, oriented for single slip, were grown by electron beam zone refining. These crystals were tested in an Instron tensile machine to determine the temperature

and strain rate dependence of the flow stress. The temperature range studied was 4.2 to 550°K, at two strain rates differing by about a factor of 100. At low temperatures the effect of both the temperature and strain rate could be rationalized satisfactorily in terms of the Peierls' mechanism, when the deformation is controlled by the nucleation of pairs of kinds [the Dorn–Rajnak model]. Author (NSA)

N66-27394# California Univ., Berkeley. Lawrence Radiation Lab.

DISLOCATION MECHANISMS OF MOLYBDENUM SINGLE CRYSTALS AT LOW TEMPERATURES

Silvanus Siu-Wai Lau Jan. 1966 34 p refs
(Contract W-7405-ENG-48)
(UCRL-16643) CFSTI: HC $2.00/MF $0.50

The effects of temperature and strain rate on flow stress of Mo single crystals were investigated. The flow stress increased slightly as the temperature decreased from approximately 600° to 425°K. A rapid increase in flow stress then occurred upon testing at lower temperatures. The strong temperature and strain rate dependence of the flow stress (below 425°K) were rationalized satisfactorily in terms of the Dorn and Rajnak theory of the Peierls' mechanism of plastic deformation. Above 425°K, the experimental results did not agree exactly with the theory, which indicates that there might be some other, as yet unidentified, thermally activated mechanism operative in this region. Author (NSA)

N66-27404# Rocky Flats Div., Dow Chemical Co., Golden, Colo.

THE EFFECT OF COMPOSITION ON THE CORROSION OF PLUTONIUM METAL

M. A. Thompson 3 Feb. 1965 5 p refs
(Contract AT(29-1)-1106)
(RFP-511) CFSTI: HC $1.00/MF $0.50

Detailed spectrographic analysis, metallography, and electron microscopic examinations were conducted on a large number of plutonium samples that had been stored under approximately the same conditions for periods up to several years. The samples were stored in 1 atm of helium and generally outgassed 1 to 2 mm of gas, primarily hydrogen. Storage time was up to 2 yr. The results for allowed delta phase plutonium showed that Cr, Fe, Mn and the total impurity contents were significantly higher in the corroded samples. Just the opposite was found to be true for the unalloyed metal. NSA

N66-27452# Rocky Flats Div., Dow Chemical Co., Golden, Colo.

VAPOR DEPOSITED FILM DISTRIBUTION ON CURVED SUBSTRATE SURFACES

R. L. Beno 1 Mar. 1966 8 p refs
(Contract AT(29-1)-1106)
(RFP-647) CFSTI: HC $1.00/MF $0.50

A comparison between calculated and experimental film thickness distribution on curved substrate surfaces is described. Using copper as evaporant, the emission characteristics of a tantalum crucible and a surface emitting pan source are compared. Two simultaneously emitting tantalum crucibles, situated beneath the exterior of a hemispheric substrate surface, did not upset distributions as determined by Knudsen's cosine law. Author (NSA)

N66-27469# New York Univ., N. Y. Dept. of Metallurgy and Materials Sciences.

A STUDY OF THE THERMODYNAMIC PROPERTIES OF INTERMETALLIC COMPOUNDS Technical Progress Report Oct. 1965 23 p ref

(Contract AT(30-1)-2916)
(NYO-2916-10) CFSTI: HC $1.00/MF $0.50

The activity and partial molar enthalpy of solution of Mg in liquid Mg–Ge alloys was determined by an improved isopiestic method and the results given. A theory of retrograde solubility for semiconducting AB compounds is discussed, and the growth and equilibration experiments performed on magnesium stannide monocrystals are described. NSA

N66-27477# Centre National de Recherches Metallurgiques, Liege (Belgium).

A STUDY ON PLASTIC FATIGUE EMBRITTLEMENT OF REACTOR VESSEL STEELS Quarterly Progress Report No. 7, Jul. 1–Sep. 30, 1965

Oct. 1965 49 p
(Contract EURATOM-005-63-12 TEEB)
(EURAEC-1475; EUR-2396) CFSTI: HC $2.00/MF $0.50

The Charpy-V-notch impact strength properties of A 302 B, Ducol W30, and Soudotenax 56 steels after various types of damage by plastic fatigue under compression-tension were studied. An investigation was made on the effects of alternate plastic deformation cycles according to various cycle rates at a temperature of 300°C. A few Charpy-V-notch embrittlement tests were also carried out on one of the steels that had undergone artificial aging at 300°C after fatigue at ambient temperature. The results obtained confirm some of the observations made previously, namely, that the impact strength, after plastic fatigue at 20°C, seems to increase in the low temperature region. On the other hand, plastic fatigue at 300°C seems to cause a noticeable embrittlement, which is evidenced by a slip in the transition curve. Such a slip is of the same order of magnitude as that produced by strain-hardening and aging, though slightly above it for two of the steels under examination. Author (NSA)

N66-27506# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.

METALLURGY Quarterly Progress Report No. 29, Oct. 1–Dec. 31, 1965

[1965] 19 p refs
(Contract AT(11-1)-599)
(USBM-RC-1220) CFSTI: HC $2.00/MF $0.50

Evaluation of HfC castings disclosed that the practice of bottom-gating the molds eliminated the problem of porosity, which heretofore was a major problem. Tensile strength and hot hardness data were obtained. Microprobe analysis of the ring surrounding each oxide particle in thorium–thoria cermets showed the ring to be ThO_2. Its different appearance was due to a slight variation in stoichiometry and not to the alloying procedure. Progress in the investigation of the solid-solution region involving the monocarbide of urnaium and oxygen in the ternary system U–C–O at 1700°C is reported. A quotation of costs to reprocess about 80 kg of W–Re scrap into prealloyed powder revealed the cost of reprocessing would be 40% greater than the outright purchase of an equivalent amount of elemental powders. Suitability of extruded bars for fabrication to sheets was evaluated by chemical analysis, metallographic examination, and ultrasonic inspection. Samples of test specimens for tensile and creep testing were prepared for evaluation. NSA

N66-27581# Combustion Engineering, Inc., Windsor, Conn. Nuclear Div.
CORRELATIONS BETWEEN SENSITIZATION AND STRESS CORROSION CRACKING OF 300 SERIES STAINLESS STEELS Progress Report, 1 Jul.-30 Sep. 1965
J. J. Koziol and S. S. Christopher Oct. 1965 37 p refs
(Contract AT(30-1)-3256)
(CEND-3256-250; EURAEC-1508) CFSTI: HC $2.00/MF $0.50

Efforts were concentrated on procurement and installation of the test equipment, procurement of specimen materials, and design and fabrication of the test specimens. Checkout of the test system and chemical sampling procedures are currently underway. Arrangements for drawing, swaging, and application of a nickel surface layer to the tubing are being made. Author (NSA)

N66-27582# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
EXPANSION PROPERTIES OF Pu-1 WT. % Ga ALLOYS
J. M. Taylor 25 Oct. 1965 7 p ref Presented at Libby Rockcroft Inform. Exchange Meeting, Harwell, England
(Contract AT(45-1)-1830)
(BNWL-SA-382; CONF-651119-6) CFSTI: HC $1.00/MF $0.50

Dilatometric expansion tests with a Pu-1 wt. % Ga alloy were compared with expansion data obtained using X-ray diffraction. Differences were observed due to the deformation of the dilatometer specimens. When the Pu-1 wt. % Ga alloy dilatometer specimen deformed sufficiently to be supported by a holder, the expansion curves obtained by the two methods agreed very well. Author (NSA)

N66-27585# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
SURVEY OF URANIUM-CARBON-NICKEL TERNARY DIAGRAM [ETUDE DU DIAGRAMME TERNAIRE URANIUM-CARBONE-NICKEL]
Francois Anselin, Daniel Calais, and Jean-Claude Passefort Aug. 1965 32 p refs In FRENCH
(CEA-R-2845)

The U-C-Ni ternary diagram presents, in addition to the intermetallic compounds of U-Ni and uranium carbides, two mixed carbides UC_2Ni and U_2C_3Ni. The first carbide is decomposed from 1400°C; the second is stable up to 1800°C. Author (NSA)

N66-27640# General Electric Co., Schenectady, N. Y. Research and Development Center.
INFLUENCE OF INTERSTITIAL IMPURITIES ON THE LOW-TEMPERATURE STRENGTH AND DUCTILITY OF BODY-CENTERED CUBIC METALS Final Report, 14 May 1963-31 Mar. 1966
D. F. Stein and J. L. Row, Jr. Mar. 1966 28 p refs
(Contract DA-31-124-ARO(D)-95)
(AROD-4074-2; AD-631708) CFSTI: HC $2.60/MF $0.50

A new technique for removing interstitial impurities from body-centered cubic metals was devised in which a very high purity atmosphere of hydrogen was maintained over samples being heated at high temperature. For iron, this techniques was shown to reduce the carbon to less than 0.005 ppm, nitrogen to less than 2 ppm, and oxygen as low as 3 ppm. The level of oxygen also depended upon the oxygen concentration in the starting material. The high-purity hydrogen purification technique was combined with other techniques such as zone melting, and high-purity arc melting to produce iron, molybdenum, and tungsten of high purity with respect to interstitial impurities. The effects of interstitial impurities on the mechanical properties of these metals were examined. Author (TAB)

N66-27650# Birmingham Univ. (England). Dept. of Industrail Metallurgy.
RESEARCH ON HOT WORKING OF METALS, WITH PARTICULAR REFERENCE TO MICROSTRUCTURE, MECHANICAL PROPERTIES AND TEXTURE Technical Report (Final), Jan. 1961-Apr. 1964
I. L. Dillamore and W. T. Roberts [1964] 114 p refs
(Grant AF-EOAR-61-6)
(AD-631407) CFSTI: HC $4.00/MF $0.75

The structure and stress-strain behavior of O.F.H.C. copper deformed at temperatures in the range −196°C to 600° C, and at two strain rates, 5×10^{-3} and 5×10^{2} sec^{-1}, were studied. A correlation was made between the structures observed optically and by transmission electron microscopy. At the low strain-rate the deformation processes varied considerably over the temperature range, but at the high strain rate the variation was small. Indications of deformation twinning were found at the high strain rate at temperatures up to 450°C. Cross-slip was favored by the high strain-rate. The effect of deformation temperature on the preferred orientation produced by rolling a number of pure f.c.c. metals was studied. Variations in the rolling texture could be related to the ease of cross slip in the metal, and this concept was used to estimate the stacking fault energy of some f.c.c. metals. The rolling textures developed in f.c.c. and b.c.c. metals are explained in terms of realistic stress systems, and the variation in texture through the thickness of rolled sheet is related to rotations of the effective stress system which are governed by friction between the sheet and rolls. Author (TAB)

N66-27661# Naval Research Lab., Washington, D. C.
THE EFFECTS OF THREE AQUEOUS ENVIRONMENTS ON HIGH STRESS LOW-CYCLE FATIGUE OF 18% NICKEL MARAGING STEELS
C. D. Beachem and T. C. Lupton Feb. 1966 33 p refs
(NRL-Memo-1685; AD-631545) CFSTI: HC $3.60/MF $0.50

Base plate and weld specimens of 200 ksi and 250 ksi (nominal yield) grades of 18% Ni maraging steels were tested as side-grooved plane-strain cantilever beam specimens in distilled water, water 'inhibited' with $NaCrO_4$, and 3-1/2% NaCl solution, to determine the susceptibilities of these steels to both corrosion fatigue and sustained load crack growth. Stress intensities below which negligible crack growth occurred during twenty cycles were found to be about 95% of K_{Ic} for 250 grade base plate in distilled water, 73% of K_{Ic} for 250 grade tested in either the salt water or the sodium chromate solution, 88% of K_{Ic} for the 200 ksi grade base plate in all three environments, and essentially 100% of K_{Ic} for the 200 ksi weld metal in all three environments. Crack extension was found to be negligible in twenty cycles at a K_I of 65 ksi $\sqrt{in.}$ in the 250 ksi grade welds in all environments. Author (TAB)

N66-27743*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
DETERMINATION OF THE WELDABILITY AND ELEVATED TEMPERATURE STABILITY OF REFRACTORY METAL ALLOYS Tenth Quarterly Report, 21 Sep.-20 Dec. 1965
G. G. Lessmann and D. R. Stoner [1965] 30 p refs
(Contract NAS3-2540)
(NASA-CR-54975; WANL-PR-(P)-010) CFSTI: HC $2.00/MF $0.75 CSCL 11F

Progress is reported in a program to determine the weldability and long time elevated temperature stability of promising refractory metal alloys, in order to select those most suitable for use in advanced alkali-metal space electric power systems. As an addition to this program, an evaluation of the effect of oxygen contamination on the weldability and thermal stability of refractory metal alloys was made. Process and test controls employed throughout the program emphasize the influence of interstitial elements on the properties of refractory metal alloys. Stringent process and test procedures are used, including continuous monitoring of the TIG weld chamber atmosphere, electron beam welding in a 10^{-6} torr vacuum, aging in furnaces employing hydrocarbon free pumping systems providing pressures less than 10^{-8} torr, and chemical sampling following successive stages of the evaluation for verification of these process controls. C.T.C.

N66-27744*# TRW Equipment Labs., Cleveland, Ohio.
DETERMINATION OF ELEVATED TEMPERATURE FATIGUE DATA ON REFRACTORY ALLOYS IN ULTRA-HIGH VACUUM Seventh Quarterly Report, 1 Jan.-1 Apr. 1966
C. R. Honeycutt and J. C. Sawyer 15 Apr. 1966 37 p refs
(Contract NAS3-6010)
(NASA-CR-54983) CFSTI: HC $2.00/MF $0.50 CSCL 11F

Accomplishments are reported in an investigation to generate fatigue data for refractory alloys at elevated temperatures in ultrahigh vacuum environments. The objective of the investigation is to determine whether fatigue life or creep is the limiting design parameter in turbine applications involving space power systems. Notched fatigue tests were conducted at 2000°F on TZC alloy, and S/N curves were defined for "A" ratios (dynamic stress to mean stress) of 00 and 0.67. Smooth specimens of TZC have been tested at an "A" ratio of approximately 0.20 and a static load of 20 ksi. Specimens of TZM with various notch configurations are being evaluated under dynamic load conditions, and preliminary results indicate that the peak stress required for fatigue of smooth specimens is significantly greater than that required for notched specimens. C.T.C.

N66-27776# California Univ., Berkeley. Lawrence Radiation Lab.
THE THERMODYNAMIC PROPERTIES OF METALS AND ALLOYS
Phillip Douglass Anderson (Ph.D. Thesis) Jan. 1966 136 p refs
(Contract W-7405-ENG-48)
(UCRL-11821) CFSTI: HC $4.00/MF $1.00

The concentration dependence of the free energy of formation of forty-seven binary liquid alloys was studied by examining nine hundred experimental values of the partial molar free energy given in the literature. These values were selected from less reliable ones. The method of least squares was used to fit the data to ten different solution models of varying degree of complexity, containing from one to three adjustable parameters. The resulting tables presented in this work allow a number of conclusions to be reached at significant confidence levels regarding the concentration dependence on the excess free energy, providing that the alloy systems are divided into two different classes, depending on the sign of the deviation from ideality. Correlation of the magnitude of the deviation from ideality with certain physical parameters was also found. The magnitude of the excess entropy of formation was examined for forty-eight binary liquid alloys. It was found that $-1.0 < \Delta S^{xs} < 1.0$ unless the alloy system has a large exothermic heat of formation, in which case large negative excess entropies are to be expected. The results indicate that configurational contributions to this entropy are unimportant compared to other (presumably vibrational) causes. Author (NSA)

N66-27777# Societe d'Etudes, de Recherches et d'Applications pour l'Industrie, Brussels (Belgium).
STUDIES OF STEEL CORROSION IN HIGH TEMPERATURE WATER AND STEAM Quarterly Report No. 13, 1 Jul.-31 Oct. 1965
26 Nov. 1965 80 p Transl. into ENGLISH from French
(Contract EURATOM-089-62-7RDB)
(EURAEC-1500; EUR-2658) CFSTI: HC $3.00/MF $0.75

The study of surface work-hardened stainless steels oxidized in steam at 400°C and above was continued. Morphological examination of the work-hardened metal zone under the fine oxide skin, formed by lengthy residence in superheated steam, showed the presence of precipitates, even where precipitation of chromium carbides is ruled out. It was previously supposed that this might be an internal oxidation phenomenon. Use of an electron microprobe did not reveal a regular oxygen-enriched zone. However, local oxygen concentrations were observed that may be attributed to discontinuous oxide penetrations which are, undoubtedly, connected with surface tearing by rough machining. The hypothesis identifying the precipitates seen under the microscope with internal oxides must therefore be rejected. X-ray diffraction examinations, with the grazing emergence of the diffracted rays corresponding to interreticular distances of close to 2 Å, showed the presence of σ-phase in the work-hardened zone of a milled sample of type 304 stainless steel oxidized for 1000 hr in steam at 500°C. This alteration in the work-hardened zone is the result of lengthy heat treatment in the 400° to 500°C temperature zone. When the precipitates were identified, the factor responsible for behavior on re-oxidation after scaling the initial oxide skin had still to be determined. Prior studies showed that the benefit of work-hardening treatment is partly preserved after initial oxidation for 1000 hr at 500°C, whereas it disappears after initial oxidation for 1000 hr at 600°C. It was established that, with type 410 stainless steel, 1000 hr at 500°C is enough to remove all benefits of surface work-hardening. The X-ray diffraction examinations, which identified the σ-phase, revealed that the work-hardened zone underwent partial or complete recrystallization according to the type of steel and the temperature of the initial 1000-hr oxidation treatment. The degree of recrystallization revealed in this way is in complete agreement with the relatively degraded behavior on re-oxidation. Author (NSA)

N66-27779# California Univ., Berkeley. Lawrence Radiation Lab.
STRAIN AGING OF IRON ALLOYS
Raymond Andrew Busch (Ph.D. Thesis) Jan. 1966 53 p refs
(Contract W-7405-ENG-48)
(UCRL-16585) CFSTI: HC $3.00/MF $0.50

The strain aging of Fe-Mo and Fe-Cr-Mo alloys was investigated. Large strengthening effects are observed in both alloys during strain in the 400-500°C range, and in the room temperature properties after this strain. The variation of these effects with impurity content in the Fe-Mo alloy indicates that interstitial solutes are not responsible for the strengthening. The aging of specimens strained at room temperature obeys an activation energy of 42 kcal/mole and $t^{2/3}$ kinetics. This behavior is interpreted according

to the Cottrell–Bilby model for strain aging. The data indicate that a similar process occurs during strain at higher temperatures, which requires the existence of strain enhanced diffusion. The magnitude of this enhancement is estimated as ~100, i.e., the diffusivity during deformation under these conditions is about 100 times greater than the normal diffusivity at the same temperature. Author (NSA)

N66-27794# Marine Engineering Lab., Annapolis, Md.
THE NOTCH-BEND STRENGTH OF NONFERROUS ALLOYS IN HEAVY SECTIONS
H. P. Chu and A. J. Skalican Mar. 1966 19 p refs
(MEL-88/66; AD-631153) CFSTI: HC $1.60/MF $0.50

The notch-bend strength of ten nonferrous alloys was determined. Four-inch-square specimens of seven cast copper-base alloys and a cast nickel–copper alloy showed extensive yielding prior to fracture. Similar specimens of wrought 7075-T6 and extruced 2024-T4 aluminum alloys failed in a brittle manner. It is concluded that the seven cast copper-base alloys and the cast nickel–copper alloy are notch tough and thus not prone to brittle fracture in air when used in sections up through 4 inches thick.
Author (TAB)

N66-27803# Army Foreign Science and Technology Center, Washington, D. C.
CORROSION PROTECTION BY COLD PHOSPHATIZATION
V. S. Lapatukhin 23 Feb. 1966 21 p refs Transl. into ENGLISH from Zh. Prikl. Khim. (Moscow), v. 24, no. 4, 1951 p 373–382
(FSTC-HT-23-24-66- AD-630848) CFSTI: HC $2.60/MF $0.50

Following a discussion of the shortcomings of the hot method of coating iron and steel with a phosphate solution for protection against corrosion, the author describes a method of cold phosphatization involving the use of zinc dihydrophosphate, fluorine compounds, and accelerators to decrease free acidity and promote depolarization of the hydrogen liberated by phosphatization. The high corrosion resistance and strength of the phosphate coatings were demonstrated in laboratory and industrial tests.
Author (TAB)

N66-27811# Institute of Modern Languages, Inc., Washington, D. C.
ORIGINAL FOUNDRY ALUMINUM "Al 99.9 H" AS NEWER GLAZING MATERIAL [ORIGINAL-HUTTEN-ALUMINIUM "Al 99,9H" ALS NEUER GLANZWERKSTOFF]
H. Ginsberg, R. Lattey, and H. Neunzig Apr. 1966 12 p Transl. into ENGLISH from Metallwissenshaft und Technik, (Bonn), v. 3, 1960 p 183–186
(Contract DA-44-009-AMC-1563(T))
(AERDL-T-1837-66; TT-66-61032; AD-631174) CFSTI: HC $1.00/MF $0.50

Methods are described whereby aluminum and its alloys are given a glaze by the Eloxal or Alumilite anodic protection treatments. The treatments impart smoothness and glaze and a hard, thick and transparent oxide layer. Glazing processes currently in use are: the Erft process, based on a nitric acid–ammonium hydrogen fluoride solution; the Allupol II (R5 bright dip) process, based on phosphoric and nitric acids; the Aluflex process, based on sulfuric and chromic acids; and the Brytal process, based on a trisodium and soda solution. Relationships were determined between glaze and glazing process in Eloxal-treated original-foundry quality alloy Erftal and the alloys with magnesium, the Raffinals. TAB

N66-27840# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF CHARACTERISTICS OF INFLOW OF Al–Zn ALLOY MATERIAL INTO AN AC ARC DISCHARGE AND CONCENTRATION DEPENDENCE OF THE INTENSITY OF ALUMINIUM AND ZINC LINES
E. S. Obukhova and N. K. Rudnevskiy 20 Jan. 1966 11 p refs Transl. into ENGLISH from Tr. Po Khimii i Khim. Tekhnologii (USSR), no. 1, 1963 p 43–46
(FTD-TT-65-1503/1+2+4; AD-630874) CFSTI: HC $1.60/MF $0.50

Peculiarities of the entrance of the substance of Al–Zn alloys into the radiating cloud of an ac arc and the concentration dependence of the intensity of the zinc and aluminum lines were investigated. The rate of entry depends on the composition of the alloy. It may be assumed that the character of the concentration dependence of the intensity of the spectral lines of aluminium and zinc significantly depends on the peculiarities of entry of these elements into the discharge arc, the change in temperature of the irradiating cloud and the degree of ionization of the atoms. Without preliminary burning of the electrodes in the range of 20–32% zinc in the alloy an anomalous dependence of zinc concentration in the products of entry on the concentration of zinc in the alloy is observed. After preliminary burning for 80 sec the anomalous dependence is eliminated. There was absence of a correspondence between the change in zinc concentration in the entry products for the indicated interval of zinc concentration in the alloy and of the relative intensity of the zinc and aluminium lines. Reasons relative to the cause of this noncorrespondence are pointed out. Author (TAB)

N66-27859# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
FATIGUE CRACK PROPAGATION IN AIRCRAFT MATERIALS
William G. Degnan, Peter D. Dripchak, and Charles J. Matusovich Mar. 1966 74 p refs
(Contract DA-44-177-AMC-84(T))
(USAAVLABS-TR-66-9; SER-50411; AD-630928) CFSTI: HC $3.00/MF $0.75

The influence of metallurgical, chemical, and geometric variables on fatigue crack propagation rates was investigated in alloys of aluminum, magnesium, steel, and titanium. Some limited fatigue crack propagation was done in laminated plastics. A possible correlation between fatigue crack propagation, fracture toughness, and tensile strength was also investigated. All materials are ranked according to their resistance to fatigue crack propagation. The critical plane strain fracture toughness, critical plane stress fracture toughness (where applicable), ultimate tensile strength, and per cent elongation are also reported for all materials. For the materials tested in this program, there was no appreciable thickness or chemical effect. Shot-peening did increase resistance to fatigue crack propagation. In general, there was an increase in the resistance to fatigue crack propagation in materials with greater ductility. The correlation between fatigue crack propagation and static fracture toughness was very poor. The crack propagation results of laminated plastics was also considered unsatisfactory. Author (TAB)

N66-27939# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CAST AUSTENITIC NON-NICKEL STEEL

N. P. Aleksandrova 17 Mar. 1966 6 p Transl. into ENGLISH from Mashinostr. (Kiev), no. 5, 1964 p 35–36
(FTD-TT-65-1398/1+4; AD-630992) CFSTI: HC $1.10/MF $0.50

A cast austenitic non-nickel stainless chrome–manganese steel alloyed by nitrogen was developed. The determination of the optimal amount of nitrogen for the alloying corresponding to its solubility in the alloy is based on the use of the dependence of the coefficient of activity of the nitrogen on the concentration of the alloying elements in the alloy on an iron base. TAB

N66-27890# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALIBRATION OF THE VR-5/20 THERMOCOUPLE TO CRITICAL POINTS UP TO 3000°C: DETERMINATION OF THE MELTING POINTS OF VANADIUM AND NIOBIUM OF HIGH PURITY
Yu. A. Kocherzhinskiy; G. F. Kobzenko, V. M. Pan, V. K. Sviridenko, and L. M. Yunko 17 Mar. 1966 6 p refs Transl. into ENGLISH from Akad. Nauk Ukr. SSR, no. 17, 1963 p 209–210
(FTD-TT-65-1888/1+2+4; AD-630971) CFSTI: HC $1.10/MF $0.50

A calibration graph was constructed based on the fusion points of high purity silver, gold, iron, nickel, palladium, platinum, molybdenum, and tantalum, and also from the transformation points of iron in sold state. The thermocouple was then used to determine the melting points of vanadium and niobium. The values, respectively, were 1950° and 2520°C. D.T.

N66-27891# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CORROSION STUDY XXIV: THE INFLUENCE OF TEMPERATURE ON THE PASSIVATION CHARACTERISTICS OF STAINLESS STEELS
M. Prazak and J. Spanily 17 Mar. 1966 15 p refs Transl. into ENGLISH from the Publ. "Korrosionsstudium XXIV. Einfluss der Temperatur auf die Passivierungs-Charakteristik Korrosions-Bestandiger Stahle" 10 Aug. 1960 p 2828–2837
(FTD-TT-65-1223/1+2+3+4; AD-630974) CFSTI: HC $1.60/MF $0.50

The temperature dependence of the corrosion reaction in the range of the critical passivation current, in the range of passivity, transpassivity, and of secondary passivity were determined for two typical chrome–nickel stainless steels; the dependences were quantitatively expressed by the Arrhenius equation. Certain conceptions of the mechanism of the processes concerned were built up on the basis of the activation energy values of the respective reactions. From the results it can be seen that the corrosion, in a passive state, rises very steeply with increasing temperature (in the range of 20–210°C in a ratio of 1:10,000,000), so that it may become technically significant in the case of higher temperatures. The stability of the passive state and the passivation tendency of the material decrease with equal rapidity with increasing temperature. It has been found that the effectiveness of corrosion inhibition by means of passivating inhibitors decreases as a result of this. Author (TAB)

N66-27898# Institute of Modern Languages, Inc., Washington, D. C.
SOME FINDINGS ON THE ELOXAL CAST ALLOYS AND ELOXAL CASTINGS [EINIGE UNTERSUCHUNGEN AN ELOXAL-GUSSLEGIE-RUNGEN UND ELOXAL-GUSSTEILEN]
A. Buckeley Apr. 1966 17 p Transl. into ENGLISH from Metallwissenschaft und Technik (W. Germany), v. 3, 1961 p 211–214
(Contract DA-44-009-AMC-1563(T))
(ERDL-T-1836-66; TT-66-61031; AD-631173) CFSTI: HC $1.00/MF $0.50

Increasing the titanium content within the frame established by DIN 1725/2 for the alloys G-$AlMg_3$ and 241 G-$AlMg_3$ (Cu) within 0–0.20% range refines the grain and makes the grain size less susceptible to the overheating of the smelting product. The higher titanium content impairs the glaze of the Eloxal somewhat, as do the higher concentrations of magnesium and silicon. The detrimental action of the silicon is not due to its penetration into the anodically built oxide layer. In addition, this layer becomes interrupted at those spots in which the Mg_2Si separations appear. The foundation is also pitted by these. A discussion of the imperfections of the Eloxal layers due to the silicon refining process, to the different crystal orientation and to heat curing follows. Author (TAB)

N66-27900# Naval Research Lab., Washington, D. C.
STARTER CRACKS FOR FRACTURE TOUGHNESS TESTING BY A RESONANCE FATIGUE TECHNIQUE
M. R. Achter, H. H. Smith, and P. Shahinian Mar. 1966 9 p ref
(NRL-MR-1680; AD-630871) CFSTI: HC $1.00/MF $0.50

A technique was developed for introducing fatigue cracks of a predetermined size automatically in specimens using a reverse bending resonance machine. The drop in the resonant frequency of vibration reflects the growth of cracks and it is by means of the change in frequency that the size of cracks is controlled. This technique has applicability in mechanical testing in which are required specimens containing preexisting flaws or cracks, such as fracture toughness testing, and in studies of crack propagation. Author (TAB)

N66-27918# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
A DOUBLE CANTILEVER BEAM SPECIMEN FOR DETERMINING THE PLANE STRAIN FACTURE TOUGHNESS OF METALS
R. G. Hoagland Dec. 1965 29 p refs
(Contract AT(45-1)-1830)
(BNWL-168) CFSTI: HC $2.00/MF $0.50

The feasibility of the testing method for obtaining data under conditions of limited space is demonstrated. Two favorable features are the amount of fracture toughness data that can be obtained from one specimen and the restraint against excessive deformation near the crack tip provided by the sharp grooves in the specimen. NSA

N66-27922# Battelle Memorial Inst., Columbus, Ohio.
PHASE EQUILIBRIA IN THE URANIUM-TUNGSTEN-OXYGEN SYSTEM
Roy A. Smith, Donald E. Kizer, Edward O. Speidel, and Donald E. Keller 17 Jan. 1966 22 p refs
(Contract W-7405-ENG-92)
(BMI-1755) CFSTI: HC $0.50/MF $0.50

A ternary eutectic, oxygen-8 at. % uranium-22 at. % tungsten, melting between 1300° and 1325°C was found to lie within a UO_2–U_xWO_3–tungsten three-phase region. The ternary-eutectic composition is near an apparent quasi-binary UO_2–U_xWO_3 eutectic. Fragmentary data suggest a low-melting (1300°C or below) ternary eutectic between

UO_2, U_xWO_3, and UO_2WO_4 on the oxygen-rich side of the UO_2–U_xWO_3 quasi-binary. Between 1250° and 1300° C, the $U_xWO_3UO_2$–tungsten region is split into $UO_2U_xWO_3$–WO_2 and UO_2–WO_2–tungsten regions by a peritectoid reaction between U_xWO_3 and tungsten to form UO_2 and WO_2. At 1800° C, liquid-phase formation was observable in alloys on the oxygen-rich side of a $UO_{2.012}$–tungsten tie line. Negligible chemical interaction of molten UO_2 and tungsten at 2800° C indicates that UO_2 and tungsten form a eutectic or divorced peritectic near UO_2. Author (NSA)

N66-27967# IIT Research Inst., Chicago, Ill. Metallurgical Engineering Dept.
ELECTRONIC STRUCTURE OF COPPER-ZINC SOLID SOLUTIONS DEDUCED FROM THEIR X-RAY K ABSORPTION SPECTRA
H. C. Yeh and Leonid V. Azaroff Mar. 1965 10 p refs
(Contract Nonr-1406(07))
(TR-65-1)

Concepts involved and results of testing are discussed for the deduction of the electronic structure of Cu–Zn solid solutions from an examination of the fine structure of their X-ray K absorption spectra. Absorption edge structures were determined for four rolled foil alloys, with zinc contents of between 4.64 and 28.80 atomic %, by employing a two-crystal spectrometer and two Si crystals having halfwidths of less than 10 sec for Cu K alpha radiation. Examination of final absorption curves shows that the substitution of Zn atoms with one extra 4_s electron decreases the number of such empty states in the immediate vicinity of an absorbing Cu atom; and the successive and systematic decline of the first maximum, from its magnitude in pure Cu, is seen. When the number of empty 4_s states in the vicinity of an absorbing Cu atom is increased, the first maximum is relatively much more pronounced because the Cu atoms are virtually surrounded only by Ni atoms having no 4_s electrons. The results are construed to confirm the proposed interpretation of X-ray spectra as a superposition of the spectral curves of individual absorbing atoms whose fine structures depend on the electronic structure of the absorbing atoms and their nearest neighbors. M.W.R.

N66-27994# United Kingdom Atomic Energy Authority, Risley (England). Reactor Group.
APPLICATION OF STEREO ELECTRON METALLOGRAPHY TO DETERMINATION OF CRYSTAL ORIENTATION
R. M. Haines 1966 15 p refs
(TRG-1161(W)) HMSO: 2s 6d

The angular relationships between the crystallographic faces of grain boundary holes, formed at elevated temperature in an irradiated material (beryllium) during slow strain to rupture, have been measured stereoscopically on electron micrographs. The results show that the orientation of the holes, and thus of the adjacent matrix, can be determined to better than 5°. They also confirm that the holes themselves are practically equiaxed. The method suggests itself as a possible way of measuring grain boundary orientations and relative surface energy relationships for other materials after suitable treatment to induce cavitation, provided that their low-temperature fracture characteristics are suitable for revealing the grain boundary holes. Author

N66-28080*# Washington Univ., Seattle.
X-RAY ANALYSIS OF FATIGUE DAMAGE IN COPPER
Roy Gene Baggerly (M.S. Thesis) 1966 49 p refs
(Grant NsG-484)
(NASA-CR-76754) CFSTI: HC $2.00/MF $0.50 CSCL 11F

A Warren–Averbach X-ray line profile analysis was applied to broadened X-ray diffraction peaks from copper deformed in fatigue. The copper specimens were fatigued by four point bending at various strain amplitudes, and measurements were made at various fractions of the total fatigue life. The analysis results in an estimation of (1) an average coherently diffracting domain size in a direction normal to the diffraction planes; and (2) a strain distribution function. The strain distribution function is in terms of the root mean square strain, which is expressed as a function of averaging distance for a direction normal to the diffracting planes. The rms strains were found to be a function of the fatigue strain amplitude level, increasing with amplitude and reaching a maximum limiting value during the first 2% of the fatigue life. Conclusions are in agreement with current theories of fatigue damage in metals. The result that maximum hardening is achieved during the initial few percent of the fatigue life is confirmed by many other entirely different analytical techniques. Author

N66-28109# Mechanical Properties Data Center, Traverse City, Mich.
NICKEL AND CHROMIUM BASE ALLOYS Inventory Report No. 625
May 1966 16 p

This sample machine search contains the computer stored data on various nickel and chromium base alloys. Its intent is to acquaint the technical community with the amount and type of data available. H.S.W.

N66-28145# United Kingdom Atomic Energy Authority, Risley (England). Library and Information Dept.
STEELS DATA MANUAL. PROPERTIES OF INTEREST IN REACTOR DESIGN
B. J. Seddon, comp. 1965 235 p refs
(TRG-840(R)) HMSO: 35s

The physical, mechanical, chemical, and irradiation properties were compiled for steels of interest in reactor technology, particularly as pressure vessel and canning materials. These include: (1) low carbon, high manganese steels; (2) low alloy chromium–molybdenum steels; (3) 9% chromium–1% molybdenum steel; (4) 12% chromium steels; and (5) austenitic stainless steels. In addition, the effect of stress relief on pressure vessel steels is discussed; and specifications, temperature conversion tables, and conversion factors are presented. D.T.

N66-28154# Reactor Group, United Kingdom Atomic Energy Authority, Culcheth (England). Reactor Materials Lab.
THE HYDROGEN EMBRITTLEMENT OF NIOBIUM
B. Longson 1966 44 p refs
(TRG-1035(C))

Hydrogen in solid solution embrittled niobium was studied in the temperature range −196°C to 400°C. Susceptibility to embrittlement was not strain rate dependent at room temperature, but at the temperatures investigated susceptibility was increased by increased oxygen content (room temperature to 400° C), increased grain size (room temperature to 200° C), and by cold working (room temperature to 100°C). A hydride phase, formed by a shear process accompanied by hydrogen diffusion, was found from −74°C to about 200°C. The activation energy of both embrittlement and hydride formation was 3 kcal per g atom for a grain size of 0.0022 cm and was grain size dependent. Author

N66-28169# Polish Academy of Sciences, Warsaw.
PRODUCTION AND PROPERTIES OF SINTERED URANIUM [OTRZYMYWANIE I WLASNOSCI SPIEKANEGO URANU]
A. Hofman 1965 23 p refs In POLISH; ENGLISH summary
(INR-666/XIV/PS) CFSTI: HC $1.00/MF $0.50

They gave the method of receiving the uranium powder by the decomposing of uranium hydride /UH_3/. They investigated properties of this powder, defined the density of sintered uranium powder dependence from pressing pressure and sintering temperature. They convey the metallographic investigation of sintered uranium powder. Author

N66-28185# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
THE EFFECT OF TEMPERATURE ON THE MICRO-INDENTATION PROPERTIES OF ZIRCONIUM HYDRIDE
J. F. R. Ambler Mar. 1966 20 p refs
(AECL-2538) CFSTI: HC $1.00/MF $0.50

This investigation into the micro-indentation properties of zirconium hydride at temperatures up to 225°C, indicates that above 50°C zirconium hydride can deform plastically by at least 8 percent. This tends to support the idea that the restoration of the tensile properties of zirconium alloys containing orientated hydrides, which begins at approximately 50°C, is due to plasticity of the hydride flakes. The results obtained also indicate a much higher ultimate tensile strength for zirconium hydride than is given by tensile testing. Author

N66-28199# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
THE INITIAL FORMATION AND GROWTH OF INTERMETALLIC PHASES IN Cu-Zn SYSTEM [TWORZENIE I WZROST FAZ MIEDZYMETALICZNYCH W UKLADZIE Cu-Zn]
H. Matyja and St. Gabrycki 1965 23 p refs In POLISH; ENGLISH summary
(INR-643/XIV/PB) CFSTI: HC $1.00/MF $0.50

The rate of growth of single intermetallic α, β, and ϵ phases of Cu–Zn system has been studied. The parabolic rate growth law has been observed. Activation energies for the growth of single intermetallic phases have been calculated. Author

N66-28213# Polish Academy of Sciences, Warsaw.
INTERDIFFUSION IN THE Cu-Zn SYSTEM [WZAJEMNA DYFUZJA W UKLADZIE Cu-Zn]
St. Gabrycki 1965 27 p refs In POLISH; ENGLISH summary
(INR-667/XIV/PS) CFSTI: HC $2.00/MF $0.50

Diffusion layer-growth in the interdiffusion region of the copper–zinc binary alloy system was investigated in the temperature range of 150° to 450°C. The activation energy and diffusion coefficient K_0 were determined. An attempt was made to compare the results with results obtained by the growth of single-intermetallic phases in the copper–zinc system. The data are presented in both tabular and plotted form. A phase diagram of the copper–zinc system over the temperature range 200° to 1083°C is depicted, along with several photographs of metallic surfaces of the alloy at various temperatures. L.S.

N66-28216# Laboratorium für Betriebsfestigkeit, Darmstadt (West Germany).
FINITE FATIGUE LIFE OF NOTCHED Ck 35 STEEL SPECIMENS UNDER NON-SINUSOIDAL LOADING [ZEITFESTIGKEIT GEKERBTER PROBEN AUS STAHL Ck 35 BEI NICHTSINUSFORMIGEM BEANSPRUCHUNGSABLAUF]
E. Gassner and W. Lipp Sep. 1964 32 p refs In GERMAN; ENGLISH summary
(FB-52; ICAF-320) CFSTI: HC $2.00/MF $0.50

The influence of nonsinusoidal loading is studied in tests on notched specimens of Ck 35 steel with a tensile strength F_{tu}=90 to 100 kp/mm^2 and a stress concentration factor K_t=3.0 to 3.5. Nonsinusoidal loading is obtained by superposition of two sinusoidal waveforms of frequency 1 and frequency 3, respectively. The tests have been arranged to permit statistical evaluation of the results. Author

N66-28244# Argentina. Comision Nacional de Energia Atomica, Buenos Aires.
RADIOACTIVE TRACERS IN THE STUDY OF THE WEAR OF HARD NICKEL ALLOY BALLS [TRAZADORES RADIOACTIVOS EN EL ESTUDIO DEL DESGASTE DE BOLAS DE ALEACION NI-HARD]
Mario Pio Gomez, Basilio Rapaport, and Walsoee de Reca 1966 32 p refs In SPANISH
(CNEA-187) CFSTI: HC $2.00/MF $0.50

This study was conducted to demonstrate the wear resistance of chromium–nickel–iron alloy grinding balls used in the fabrication of cement. Cobalt 60, added to the iron melt prior to alloying, was used as a tracer to measure the amount of wear on the grinding balls. The tracer dissolves easily in the melt and its distribution is uniform in the balls. The recovery of the labelled balls is easily accomplished as the doses used are low enough so that there is no radiation danger. There was no evidence of fracture in the specimens used. It was verified that the alloy's resistance to abrasion was increased with the percentage of martensite which also increased its hardness. The wear resistance of the chromium–nickel–iron alloy balls is considerably greater than that of conventional steel balls. Transl. by R.N.A.

N66-28283# Watervliet Arsenal, N. Y. Benet Labs.
STRESS-AGING: A NEW TREATMENT FOR ALLOYS. PART FOUR: COMPARISON OF STANDARD TENSILE PROPERTIES FOR SINGLE VS. DUPLEX STRESS-AGING (THREE ULTRA-HIGH STRENGTH STEELS)
Richards H. Harrington Mar. 1966 37 p refs
(WVT-6601; AD-631422) CFSTI: HC $2.60/MF $0.50

For alloys with a high capacity for single stress-aging, duplex stress-aging may yield further gains in useful strength without destructive losses in elongation and 'Relative Toughness'. With duplex stress-aging, the proportional limits are higher than the initial tensile strengths of these three steels. Duplex stress-aging resulted in increases of 50,000 psi for the 0.1% offset yield strength for 4340 steel; 75,000 psi for the yield strength of 4335 Si-Modified; and up to 90,000 psi for the yield strength of 300M steel. For different duplex treatments, 300M steel develops proportional limits from 280,000 to 300,000 psi, yield strengths from 300,000 to 315,000 psi; elongations from 7 to 5%; reduction of area values from 34% to 31%. On a yield strength-to-density basis, duplex stress-aged 4355 Si-Modified is about equal to titanium alloy while duplex stress-aged 300M appears to be superior to any commercial alloy. Author (TAB

N66-28291# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
IMPROVING THE PLASTICITY OF SLABS OF STAINLESS STEEL WITH THE AID OF RARE-EARTH ELEMENTS

N. F. Nakonechnyy, K. K. Prokhorenko, and P. L. Zhdanov 23 Mar. 1966 7 p refs Transl. into ENGLISH from Met. i Gornorudn. Prom., Akad. Nauk Ukr. RSR (Kiev), no. 1, 1964 p 32–33
(FTD-TT-65-1787/1+4; AD-631571) CFSTI: HC $1.10/MF $0.50

The introduction of 0.1 to 0.2% cerium during the casting of an austenite and an austenite–ferrite stainless steel was found to result in improved plasticity at high temperatures both for the cast and the forged metal. Metallographic examinations revealed that the addition of cerium in such amounts reduced the microscopic nonuniformity of the steel, strengthened its grain boundaries, and inhibited the embrittling of nonmetallic inclusions by transforming them into higher melting and more plastic compounds. -TAB

N66-28313# Titanium Metals Corp. of America, New York.
DEVELOPMENT OF A STABLE-BETA TITANIUM ALLOY Thirteenth Quarterly Report, 1 Jul.–30 Sep. 1965
D. B. Hunter [1965] 36 p refs
(Contract DA-30-069-ORD-3743)
(WAL-TR-405/2-12; AD-631185) CFSTI: HC $3.60/MF $0.50

Time and temperature parameters for the 50 and 100% recrystallization of Ti–8Mo–8V–2Fe–3Al sheet were determined for the mill annealed condition and after two degrees of cold reduction. Aging response of the mill annealed sheet and of hot rolled sheet given a 25% cold reduction was determined employing aging temperatures of 800°F–1200°F, and times of 2–24 hours. From this study, 37 combinations of solution treatment and aging were selected for room temperature tensile testing. Out of these tests, one fully aged condition, and one stabilized condition, for both mill annealed and cold rolled material, were selected for further evaluation. These four conditions were then evaluated by −65° and 600°F smooth tensile tests and by room temperature, −65° and 600°F notched tensile tests. In addition, a comparison of the oxidation resistance of Ti–8Mo–8V–2Fe–3Al and the commercial alloy Ti–13V–11Cr–3Al showed that the latter alloy was more resistant to oxidation. The evaluation of the stabilized ageable beta alloys was concluded with 150 and 500 hour creep stability tests; only Ti–8Mo–8V–2Fe–3Al retained useful amounts of ductility after both exposure times. Author (TAB)

N66-28339# Metaalinstituut TNO, Delft (Netherlands).
COMPARATIVE RESEARCH OF NINE SAMPLES OF CARBON REMOVERS [VERGELIJKEND ONDERZOEK VAN NEGEN MONSTERS ONTKOLINGSMIDDEL]
L. M. Rientsma 18 Feb. 1966 10 p In DUTCH
(C66-155; TDCK-45012) CFSTI: HC $1.00/MF $0.50

Comparative tests were conducted on several carbon removers to evaluate their efficiency for use in clogged oil pumps. Among the criteria considered were the boiling and firing points, solubility, appearance, emulsifying properties, corrosion effect, oil removing and cleaning properties, ease of rinsing, and poison content. Copper, steel, and aluminum plates, heat treated at 175°C, were used in the investigations. Tabulated data are included to show the results for each product tested. Transl. by J.O.

N66-28346# Argonne National Lab., Ill. Metallurgy Div.
DIFFUSION IN GAMMA URANIUM Final Report
N. L. Peterson and S. J. Rothman Nov. 1965 92 p refs
(Contract W-31-109-ENG-38)
(ANL-6968) CFSTI: HC $3.00/MF $0.75

The diffusion of Cr, Mn, Fe, Co, Ni, Cu, and Nb tracers in γ-U was measured by use of the thin-layer-sectioning technique. The plots of log D (the logarithm of the diffusion coefficient) vs 1/T (the reciprocal of the absolute temperature) are curved at low temperatures. The data do not agree quantitatively with any of the present theories of diffusion. A Kirkendall-effect experiment with a very slight concentration gradient showed that diffusion takes place by a defect mechanism. Preannealing a sample near the melting point, cooling to the diffusion temperature without going into the β-phase, depositing the isotope, and diffusing gave the same D as a conventional experiment, indicating that excess defects were not introduced by the $\beta \rightarrow \gamma$ phase transformation. Small additions of Co were shown to have a profound effect on self-diffusion in γ-U. These results can be explained only on the basis of the vacancy or interstitialcy mechanisms.
Author (NSA)

N66-28362# Battelle Memorial Inst., Columbus, Ohio.
THE COMPATIBILITY OF URANIUM NITRIDE WITH POTENTIAL CLADDING METALS
David E. Price, Donald P. Moak, Walston Chubb, and Donald L. Keller 8 Feb. 1966 43 p refs
(Contract W-7405-ENG-92)
(BMI-1760; EURAEC-1591) CFSTI: HC $2.00/MF $0.50

The compatibility of UN with stainless steel, Fe, Cr, Ni, Zircaloy-2, Zr, and Al was studied. Disks of UN and a metal were compressively loaded in contact at temperatures between 400° and 1350°C for periods of time up to 5000 hr. The reaction products that formed at the UN–metal interfaces were studied by metallographic examination, electron-beam microprobe analysis X-ray-diffraction analysis, and hardness measurements. Observations made on Ni–UN, and Zircaloy-2–UN couples are correlated with hypothetical Ni–U–N and Zr–U–N phase diagrams. Reaction rates in UN couples with Cr, Ni, Zircaloy-2, and Zr were obtained by measuring the maximum thickness of reaction layers after heating for various times and temperatures. Heat treatments were carried out at 1000° and 1350°C for type 304 stainless steel, 700° to 1000°C for Fe, 800° to 1000°C for Cr, 600° to 1200°C for Ni, 600° to 900°C for Zircaloy-2, 600° to 700°C for Zr, and 400° to 600°C for Al. Reactions with limited amounts of excess nitrogen and oxygen present as an impurity were observed between UN and type 304 stainless steel, Fe, or Cr. (No reaction was observed between nitrogen and Fe). More extensive reactions were observed between UN and Zr, Zircaloy-2, Ni, or Al in order of increasing reaction rates.
Author (NSA)

N66-28364# Argonne National Lab., Ill.
GROWTH AND ANNEALING OF EVAPORATED ALUMINUM-SILICON FILMS
R. K. Hart and D. G. Pilney Nov. 1965 13 p refs
(Contract W-31-109-ENG-38)
(ANL-7102) CFSTI: HC $1.00/MF $0.50

The growth and annealing of aluminum films containing up to 3% silicon were studied by electron-microscope and electron-diffraction methods. The films were prepared by condensing the vapors from heated aluminum–silicon alloys onto rock-salt substrates. The textures and defect structures observed in these films, both before and after annealing, are discussed. Author (NSA)

N66-28366# Argonne National Lab., Ill. Metallurgy Div.
MECHANICAL PROPERTIES OF URANIUM COMPOUNDS

C. R. Tottle Nov. 1965 31 p refs
(Contract W-31-109-ENG-38)
(ANL-7070) CFSTI: HC $2.00/MF $0.50

Mechanical tests, in which four-point loading was employed in bending, were performed at temperatures from room temperature to 2000°C, mainly *in vacuo*, on U compounds with O_2, S, and P. A brittle-ductile transition in UO_2 was shown to exist between 1250° and 1500°C. The effect of strain rate, atmosphere, density, and surface condition was outlined. US was tested in forms incorporating UOS and/or UO_2 as impurities. The ductile transition occurred around 1000°C for UOS-bearing material, and around 1250°C for US containing UO_2. UP containing about 1% UO_2 was shown to have a transition around 1250°C. UO_2 remained stronger than the others at all temperatures except 1000°C, but was less plastic. US containing UOS was consistently the weakest material. The temperature dependence of stress was remarkably similar in all the materials between 1250° and 1750°C. Specimens of all three compounds were (under appropriate conditions) bent to deflections exceeding 2.5 mm around the inner knife edges 6 mm apart and around the outer knife edges 30 mm apart. Author (NSA)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N66-26983# Joint Publications Research Service, Washington, D. C.

MUTUAL INFLUENCE BETWEEN THE EFFECTS OF RADIATION AND THE CRYSTALLIZATION PROPERTIES OF POLYETHYLENE

Hsiao Chou and Chih-p'ing Chang *In its* Transl. on Communist China's Sci. and Technol. 5 May 1966 p 8-18 refs Transl. into ENGLISH from Kao-Fen-Tzu T'ung-Hsun (Peking), v. 7, no. 6, Nov. 1965 p 386-395 (See N66-26982 15-34) CFSTI: $1.00

Experiments were conducted to study the influence of gamma radiation on the crystalline properties of a dilute polyethylene solution, and to study the effects of gamma radiation on a polyethylene single crystal. The results of the first experiment showed that the morphology of the crystals changes regularly as the radiation dose increases; the latter experiment showed that a perfect crystal lattice had better resistance to gamma radiation, and that each sector in a hollow pyramid crystal is a structural unit with more perfect crystal lattice, and resists gamma radiation independently. The experimental procedures used are discussed and electron microscope photographs of crystal samples are included. H.S.W.

N66-27088# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

RADIATION-INDUCED DIMENSIONAL CHANGES OF RAW-COKE GRAPHITES

J. W. Helm Dec. 1965 20 p refs
(Contract AT(45-1)-1830)
(BNWL-179) CFSTI: HC $1.00/MF $0.50

Two series of irradiations were conducted to provide data on the comparative radioinduced dimensional changes of raw-coke graphites and a nuclear-grade conventional-coke graphite, CSF. The raw-coke graphites showed much less contraction than the CSF at 500° to 600°C and showed an expansion rather than a contraction at 700° to 800°C. The length changes for both the base stock and the impregnated graphite were very isotropic, particularly at the lower temperature. The CT graphites showed a much more anisotropic behavior, with the parallel samples contracting much more than the transverse samples. The length change for the raw-coke graphite in the transverse direction (550° to 650°C) was considerably less than for the other graphites. The results indicate the bonding between the coke and binder of graphite is of importance in dimensional behavior during irradiation. NSA

N66-27268# Archer-Daniels-Midland Co., Minneapolis, Minn. Research Center.

DEVELOPMENT AND OPTIMIZATION OF RESIN SYSTEMS FOR EXPANDABLE HONEYCOMB

W. J. Mc Killip, L. M. Clemens, R. H. Leitheiser, J. Lee, and C. N. Impola *In* AFSC, Wright-Patterson AFB, Ohio Aerospace Expandable Struct. [1966] p 19-50 refs (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

The conversion to a resin fiber reinforced composite, using a gaseous reactant and/or catalyst, of an initially flexible, expanded cloth or honeycomb structure impregnated with resin was studied. An attempt was made to correlate knowledge of molecular configurations with the physical and mechanical properties observed. Modulus and yield strength, tension and compression, shrinkage, and cure rate were determined for urethane, epoxy, and polyester resins. Moisture cured, three-ply glass laminates demonstrated yield strengths up to 47,000 psi and flexural moduli up to 3,000,000 psi. Small prototype structures, gassed with water vapor containing specific catalysts were rigidized in a hard vacuum within 1/2 hour. Resin gel times under one minute were recorded when premixing resin and water containing .55% trimethyl amine. D.T.

N66-27273# National Cash Register Co., Dayton, Ohio. Capsular Research and Product Development Dept.

CHEMICAL RIGIDIZATION OF PERFORMED FLEXIBLE FOAMS

J. F. Hanny, J. W. Jones, G. H. Peters, and J. C. Scott *In* AFSC, Wright-Patterson AFB, Ohio Aerospace Expandable Struct. [1966] p 165-178 (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

A chemical rigidization system for expandable space structures was designed and developed. The system uses a preformed, flexible polyurethane foam of high porosity as a matrix phase for a vinyl type monomer. The impregnated foam system is adhered to the surface of the expandable structure. Upon command, the structure may be expanded and the polymerization of the monomer initiated. The final polymer is a clear, glass-like, completely thermoset material with the following physical properties: tensile strength at 25°C, 4000 psi; refractive index, 1.5024; dielectric constant at 60 cps, 5.5; and light transmission at 4500 Å, 92%. Polymerization of the monomer is effected by a free radical generator or initiator. Studies indicate that the initiator has some tendency to decompose when dissolved in the monomer, and permitted to stand at room temperature. If the solution is allowed to stand long enough, polymerization may be initiated. Oxygen, therefore, was introduced into the system as an inhibitor, and by this method a shelf of life in excess of six months was obtained. D.T.

N66-27280# Southwest Research Inst., San Antonio, Tex. Dept. of Mechanical Sciences.
SODIUM SILICATE AS A VERSATILE STRUCTURAL MATERIAL
Herbert I. Hoffman *In* AFSC, Wright-Patterson AFB, Ohio Aerospace Expandable Struct. [1965] p 289-303 refs (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

Experiments with sodium silicate were conducted to determine its potential as an inorganic, thermal insulation and heat sink which could be shaped in space. The chemical compositions and physical properties of soluble silicates are tabulated, and some of the solid forms which can be generated by heat and vacuum are illustrated to show the successive effects of rapid heating vs. the effects of slow dehydration. It is pointed out that the rapid heating of the solution forms crusts of glass which finally generate into a rigid, coarse foam as heating continues. This foam continues to expand into a fine, white rigid foam at temperatures in excess of 600°F; when exposed to extreme heating, the material enters the molten state. Procedures are discussed, including mechanical features, conversion methods, and flexible packaging. Potential applications are examined, including silicate foaming for air drop cushioning, and thermal protection of space vehicle walls. It was concluded that the heat absorption technique of allowing a hydrated coating to calcine can be developed to meet military and space requirements. M.G.J.

N66-27301# Goodyear Tire and Rubber Co., Akron, Ohio.
HIGH-TEMPERATURE PROTECTIVE RE-ENTRY COATINGS FOR EXPANDABLE STRUCTURES
M. T. Conger and T. W. Chalmers *In* AFSC, Wright-Patterson AFB, Ohio Aerospace Expandable Struct. [1966] p 769-783 (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25
(Contract AF 33(657)-11257)

Details are given on elevated temperature leak tests and visual inspection methods used in evaluating high temperature protective reentry coatings. Inorganic and chemical vapor-deposited coatings were studied, along with coatings based upon elastomeric ablative insulation, and coatings containing silicone rubber in combination with fusible fillers. A thermal screening apparatus was used to determine the gross effect of reentry heat; criteria for further testing were coating adherence to the substrate, and no visible evidence of cracking or porosity. A cylinder test apparatus is described, in which heating and cooling rates sufficiently high to change the temperature from room temperature to 2000°F in 2 1/2 minutes can be achieved. Test procedures are varied to study the effects of different peak temperatures, heating rates, inflation pressures, and tensile stresses. Heating rates and temperature profiles are graphed. Cylindrical test specimen fabrication techniques are discussed; the coating is applied by painting. Tabulated data are included on the properties of the coatings tested; it was concluded that silicone rubber combined with glass frit offers the most promise for expandable reentry structures. M.G.J.

N66-27317*# Boeing Co., Seattle, Wash. Aerospace Group.
LINERS FOR NON-METALLIC TANKS Final Report
John T. Hoggatt and L. J. Workman Jan. 1966 54 p refs
(Contract NAS3-7944)
(NASA-CR-54868) CFSTI: HC $3.00/MF $0.50 CSCL 11J

The uniaxial and biaxial elongation properties of Kapton polyimide film were determined at −423°F. Cylindrical liners were cyclic tested to failure at liquid hydrogen temperatures to establish the potential of Kapton as a filament-wound tank liner material for liquid hydrogen containment. Author

N66-27285# California Univ., Berkeley. Lawrence Radiation Lab.
EFFECT OF LITHIUM FLUORIDE ON THE DENSIFICATION OF MAGNESIUM OXIDE
Mark William Benecke (M.S. Thesis) 20 Dec. 1965 33 p refs
(Contract W-7405-ENG-48)
(UCRL-16534) CFSTI: HC $2.00/MF $0.50

Compaction-vs-temperature studies were made on magnesium oxide and magnesium oxide +2 wt. % lithium fluoride up to 1000°C using pressures up to 4000 psi. The lithium fluoride addition allows magnesium oxide to be hot-pressed to near theoretical density at reduced temperatures and stress. The hot-pressed density must be at least 99.5% of the theoretical density of magnesium oxide for the subsequent heat treatment to yield a transparent specimen. Because the densification kinetics vary with the temperature and pressure, the hot-pressing process must be designed to yield this critical density. NSA

N66-27399# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
IMPROVING THE MECHANICAL PROPERTIES OF SLIP-CAST FUSED SILICA BY FIBROUS REINFORCEMENT Final Report, 1 Jul. 1964-30 Jun. 1965
W. J. Corbett, A. T. Sales, and J. D. Walton, Jr. 6 Aug. 1965 42 p refs Prepared for Sandia Corp., Albuquerque, N. Mex.
(Contract AT(29-1)-789)
(SC-DC-66-1130) CFSTI: HC $2.00/MF $0.50

The mechanical properties of slip-cast fused silica containing discontinuous, randomly-oriented, ceramic fibers were investigated. The reinforcements investigated were an amorphous aluminosilicate fiber, a zirconia fiber, a synthetic mullite fiber, and silicon carbide whiskers. Three techniques were developed for producing slips containing fiber and finely-divided silica. These were: ball milling of fiber and fused silica slip, blending of dried and reground fused silica slip with chopped fiber and water, and direct incorporation of whiskers into fused silica slip. Casting slips with fiber concentrations as high as 50 vol % were obtained using the ball milling technique. The percent solids content of the fiber slips was dependent on the volume percent fiber and was in the 70% to 82% range. The slips were cast, using plaster molds, as flat plates, cylinders, and a small radome shape. Good fiber dispersion was obtained with a random orientation of the fiber. The sintering parameter that most influenced the mechanical properties of these composites was the cristobalite content. This parameter was established for a firing temperature of 2200°F. Sintering time was varied to control the cristobalite formation for a particular volume percent fiber in the slip. The variation of elastic modulus with percent cristobalite and percent of theoretical density, modulus of rupture, tensile strength, and impact strength for fused silica were used as standards to determine any degree of fiber reinforcement. Although no reinforcement was detected, volumes of 2-1/2% and 5% synthetic mullite and 2-1/2% zirconia fibers were not detrimental to the mechanical properties of fused silica when evaluated on the basis of percent of theoretical density for fused silica. The elastic moduli of 5% zirconia fiber and 7-1/2% silicon carbide whiskers were respectively 50% and 25% greater than fused silica at the same porosity. When used to determine the strength of composites that are dependent on short fibers for reinforcement, the value of the modulus of rupture test was challenged since the geometric computations are based on the strength of the outer surfaces. Since the surfaces of these composites did not contain appreciable amounts of fiber, this critique seemed confirmed by the test results.

Similarly the significance of the Izod impact strength and tensile strength, using the dimetral compression test, were critically analyzed. The value of Weibull statistics in the analysis of these data for brittle materials demonstrated the value of the tensile strength test. It was demonstrated that the incorporation of discontinuous, randomly-oriented, ceramic fibers into slip-cast fused silica is possible, without sacrificing the fabrication advantages of the slip-casting process. The feasibility of obtaining significant improvements in the physical properties of slip-cast fused silica by the incorporation of discontinuous, randomly-oriented, ceramic fibers was not conclusively demonstrated.
Author (NSA)

N66-27427# Marine Engineering Lab., Annapolis, Md.
EFFECT OF WATER ABSORPTION ON DIMENSIONAL STABILITY OF ELECTRIC MOTOR ENCAPSULATING MATERIALS
John F. Tobin Mar. 1966 15 p refs
(MEL-421/65; AD-630566) CFSTI: HC $1.60/MF $0.50

Experiments with epoxy materials to determine their dimensional change as caused by water absorption (when used as encapsulating materials for submersible electric motor windings) were conducted with sufficient sample population to allow statistical analysis. The studies showed that the water absorption rates of the three epoxies were identical and that deep submergence pressures did not accelerate the absorption rate or the dimensional growth of the epoxies. Dimensional changes due to water absorption were found to be very small in all cases. Author (TAB)

N66-27434# AVCO Corp., Wilmington, Mass. Space Systems Div.
MICROSTRUCTURE STUDIES OF POLYCRYSTALLINE REFRACTORY OXIDES Sumary Report, 25 May. 1965–24 Mar. 1966
W. H. Rhodes, D. J. Sellers, T. Vasilos, A. H. Heuer, R. Duff et al 24 Mar. 1966 14 p refs
(Contract NOw-65-0316-f)
(AD-630776)

The effect of surface structure on the transverse bend strength of polycrystalline Al_2O_3 and MgO was studied. A consistent relationship between strength and improved surface structure was attained at MgO tested at 77°K while such a relationship did not exist for testing at 296°K. In Al_2O_3, the strength-surface structure relationships were not consistent although several thermal cycles strengthened this material at both 77°K and 296°K by approximately 40%. Hot forging achieved crystallographic and/or mechanical texturing in polycrystalline MgO and Al_2O_3. Specimens were obtained which in the case of Al_2O_3 showed strengths at 23°C and 1300°C between 25% and 200% higher than would be predicted from existing grain size—porosity strength relations. The bend strengths for forged MgO were equivalent to hot pressed material having a similar microstructure. SiO_2 additions caused a marked weakening of Al_2O_3, while MgO additions gave specimens which were similar to or perhaps slightly stronger than unalloyed specimens. The magnesia addition increased the high temperature ductility and lowered the brittle-ductile transition temperature by approximately 50°C. The strongest MgO specimen reported to date, 55,000 psi, was achieved by what appears to be a compressive surface layer of Mg_2SiO_4. Author (TAB)

N66-27478# Georgia Univ., Athens.
THE INFRARED SPECTRA OF NEOPRENE BEFORE AND AFTER GAMMA IRRADIATION
Barry Hilton Moore (M.S. Thesis) 1965 40 p refs
(Contract AT(40-1)-2418)
(TID-22652) CFSTI: HC $2.00/MF $0.50

The infrared spectra of Neoprenes, type W, CG, and GN-M2, were measured and vibrational assignments were made for the observed bands. A high degree of crystallinity was observed in Neoprene type CG, a much smaller degree in types W- and GN-M2. Irradiation with gamma rays of Neoprene type W at doses of 6.7×10^7, 2.5×10^8, and 8.7×10^8 rads, of type CG at 5.5×10^8 rads, and of type GN-M2 at 9.2×10^8 rads produced new bands at 965, 1243, and 1715 cm^{-1} together with shifting of the methylene stretching bands to higher frequencies. The predominant effects were the formation of trans-vinylene unsaturation and crosslinking. Formation of methyl groups and double bond conjugation were also observed. It was concluded that trans-vinylene growth is a zero order reaction followed by first-order decay of trans-vinylene groups. The decay constant k_2, the initial growth rate G_0, and the concentration at infinite dose were calculated to be 4.9×10^{-23} g/ev, 2.1, and 7.2×10^{-4} moles/g, respectively. Irradiation with doses higher than 2.5×10^8 rads eliminated crystallinity in Neoprene and crosslinking was postulated as the cause. It was determined that Neoprene oxidized slightly in conjunction with irradiation. Exposure to air enormously increased the oxidation of irradiated Neoprene. Author (NSA)

N66-27521# Union Carbide Nuclear Co., Oak Ridge, Tenn. Y-12 Plant.
POLYVINYL PLASTISOL QUALITY STUDY
C. R. Schmitt 9 Mar. 1966 20 p refs
(Contract W-7405-ENG-26)
(Y-1508) CFSTI: HC $2.00/MF $0.50

Laboratory studies were made on samples of various production quantities of polyvinyl chloride plastisols to determine the cause of cracks, blisters, and other imperfections in flexible molds made from the material by heat curing. Moisture was found to be the major troublesome contaminant of those batches that produced cured molds of inferior quality. Although the quality of the plastisol could be upgraded by vacuum treatment to remove moisture, degradation re-occurred after subsequent exposure to a moist atmosphere. Author (NSA)

N66-27569 Office of Naval Intelligence, Washington, D. C. Translation Section.
APPLICATION OF PLASTIC COATINGS TO LARGE ARTICLES [NANESENIYE PLASTMASSOVYKH POKRITIY NA KRUPNOGABARITNYYE IZDELIYA]
I. Ya. Al'shits and A. M. Koryavin [1965] 8 p Transl. into ENGLISH from Vestn. Mashinostr. (Moscpw), no. 1 p 48–51
(ONI-TRANSL-2058; AD-630743)

Thin-layer plastic coatings applied to various parts and articles have excellent anti-corrosion and, in the case of some plastics, high anti-friction properties. There are many different ways of applying thin plastic coatings, for example: gas-flame, jet spray, vibrational, centrifugal, vortex and others. Of these, the method most widely used both at home and abroad is that of applying finely-dispersed powdered plastic to the surface of the part or article. In this method, the metallic article is heated to a temperature somewhat higher than the melting temperature of the powdered polymer and charged into a tank containing a suspension of the

powder. On coming in contact with the heated surface of the article the polymer melts and, with additional heating, flows over the surface, forming a continuous uniform coating. TAB

N66-27578# Naval Research Lab., Washington, D. C.
MOISTURE ASSISTED SLOW CRACK EXTENSION IN GLASS PLATES. A REPORT OF STUDIES CONDUCTED AT ERNST MACH INSTITUTE, FREIBURG, W. GERMANY, 6 MAY–3 AUGUST 1965
G. R. Irwin 28 Jan. 1966 28 p refs
(NRL-MEMO-1678; AD-630833) CFSTI: HC $2.60/MF $0.50

Exploratory studies of moisture assisted stable (slow) crack extension in a 4mm thickness plate glass were made. It was found that satisfactory control of crack orientation could be obtained using a double cantilever type specimen if the total angle bisected by the crack was as large as 90°. No side grooves or guiding scratches were required or used. Trials were made at room temperature using 50% relative humidity, dessicated air, and saturated air. The moist test results were difficult to interpret. The remaining results suggest that, for a fixed stress level near the crack, the water assisted crack speed is nearly proportional to the water content of the air. The restricted mobility of water molecules between glass surfaces less than 50 Å apart is the dominating influence controlling shape of the reponse curves (crack speed as a function of stress field force). The crack speed magnitude and the leveling of crack speed prior to onset of fast fracture are closely related to compositional and structural aspects of the glass. Author (TAB)

N66-27582# Army Natick Labs., Mass. Clothing and Organic Materials Div.
MEASUREMENT OF RUBBER ELASTICITY AT LOW TEMPERATURES USING A TWIST RECOVERY APPARATUS
Angus Wilson Jan. 1966 40 p refs *Its* Tech. Rept.-66-4-CM (C&OM-14; AD-630909) CFSTI: HC $2.00/MF $0.50

The apparatus and methods described in the report provide a new means of observing and measuring the low-temperature behavior of rubber. Since, in actual use, rubber is very often deformed only slightly, the new method subjects the test specimen to a twise deformation of 360°, resulting in an elongation of approximately 5% along its side. The apparatus permits twist recovery and percentage of set to be measured at specific constant temperatures and also to be correlated with rising temperatures. The results show that, with the exception of a series of ehtylene/propylene/diene (EPD) rubber compounds, both the elasticity and the flexibility of rubbers are regained within the same range of low temperatures. The stress-strain behavior of EPD rubbers, which differs from that of other types of rubber, is briefly discussed. These techniques can be used not only to examine the basic behavior of rubbery materials, but also in the routine inspection of rubber items and components.
Author (TAB)

N66-27613# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Materials Lab.
ELASTIC STRESS-STRAIN PROPERTIES OF FIBER REINFORCED COMPOSITE MATERIALS Technical Report, Aug. 1964–Jun. 1965
James M. Whitney and Mitchell B. Riley Dec. 1965 72 p refs
(AFML-TR-65-238; AD-631334) CFSTI: HC $3.00/MF $0.75

Approximate equations for determining the elastic constants of a unidirectional fiber reinforced composite material from constituent material properties are derived. In particular, equations are developed for longitudinal modulus, transverse modulus, and Poisson's ratio, while an equation already available in the literature is suggested for shear modulus. Classical theory of elasticity is applied to simplified models of a composite unit cell resulting in closed form solutions. Airy stress functions are applied to the fiber and matrix with boundary conditions requiring continuity of displacements across the fiber–matrix interface (perfect bonding is assumed) and continuity of the appropriate stresses. Graphical results are shown for glass–epoxy composites and for boron–epoxy composites. For a composite with a high volume percent of reinforcement these graphs clearly indicate that even though resin properties are the predominant factor in transverse modulus, and shear modulus they can be improved by high modulus fibers such as boron. Experimental results were obtained for longitudinal modulus, transverse modulus, shear modulus and Poisson's ratio of a boron fiber reinforced composite. A general discussion of stress–strain relationships as applied to fiber reinforced composites is also presented. Considerable detail is given concerning the fabrication of the experimental samples. Author (TAB)

N66-27720# Picatinny Arsenal, Dover, N. J. Plastics Technical Evaluation Center.
LITERATURE SURVEY ON THERMAL DEGRADATION, THERMAL OXIDATION, AND THERMAL ANALYSIS OF HIGH POLYMERS, II Annotated Bibliography, 1 Oct. 1962–1 Mar. 1965
Dorothy A. Teetsel and David W. Levi Jan. 1966 157 p refs
(PLASTEC-10; AD-631655) CFSTI: HC $4.00/MF $1.00

A bibliography of references, many of them annotated, is presented. This bibliography is the result of a literature survey on thermal degradation, thermal oxidation and thermal analysis of high polymers. These references cover the period from about 1 October 1962 to 1 March 1965. 702 items are given. These are grouped under general and material headings. A subject index and an index of authors are provided. This bibliography brings PLASTEC Note 7 (AD-423 546) published June 1963, up-to-date. Author (TAB)

N66-27828# Rubber Research Inst. TNO, Delft (Netherlands).
STRESS RELAXATION AND CURING OF FLUORINATED ELASTOMERS Technical Report, 1 Dec. 1963–30 Nov. 1964
N. Luyendijk Wright-Patterson AFB, Ohio. AF Mater. Lab., Jan. 1966 108 p refs
(Contract AF 61(052)-763)
(AFML-TR-65-230; AD-630907) CFSTI: HC $4.00/MF $0.75

Stress relaxation of elastomeric materials is one of the principal causes of mechanical failure of elastomeric components in today's flight vehicle. This phenomenon of stress relaxation in current fluorosilicone elastomers was thoroughly investigated and the results reported. The most significant conclusion from this work is that after the measurement of an elastomeric compound of different cross-link densities that random chain scission of polymer chains is responsible for stress decay during relaxation. A rate of modulus decrease in intermittent measurements is only slightly lower than the continuous relaxation rate, it is concluded that only a small fraction of the broken bonds are reformed. The information presented provides some insight as to the points of weakness in an elastomers vulcanizate and at the same time indicates an area where research efforts should be directed if we are to find elastomers having high strength at elevated temperature. Author (TAB)

N66-27871# Rock Island Arsenal Lab., Ill. Research and Engineering Div.
EVALUATION OF REMOVABLE FILM CORROSION PREVENTIVES Final Technical Report
William F. Garland Mar. 1966 28 p refs
(RIA-66-774; AD-631326) CFSTI: HC $2.00/MF $0.50

Twelve pressure-sensitive tapes and one strippable vinyl plastisol material are evaluated for possible use as removable film corrosion-preventive materials. The materials were tested for fungus resistance and adhesion as well as for their ability to protect metals from corrosion and weathering. The tape backings were of three types: paper, plastic, and fabric. All materials were found to be fungus proof, and the tapes were tack-free during adhesion testing. A plastic-backed tape provided the best combination of protection (accelerated weathering, corrosion, and fungus resistance) and ease of removal of any of the tapes tested. A weather-resistant polyvinyl-fluoride-backed tape and the strippable vinyl plastisol were the two most corrosive materials tested. Author (TAB)

N66-27951*# Stanford Univ., Calif. Dept. of Materials Science.
MECHANICAL BEHAVIOR OF POLYCRYSTALLINE NONMETALLICS AT ELEVATED TEMPERATURE Progress Report, 1 Oct. 1965–31 Mar. 1966
Oleg D. Sherby and Peter Burke [1966] 15 p refs
(Grant NGR-05-020-084)
(NASA-CR-75642) CFSTI: HC $1.00/MF $0.50 CSCL 20B

Creep tests were conducted on polycrystalline specimens of sodium chloride in a dead load compression creep unit at temperatures of 512°C and 740°C and stress levels varying from 38 psi to 850 psi as part of a program designed to study the mechanical behavior of polycrystalline nonmetallic materials at elevated temperatures. Stress, temperature, creep rate, grain size, and subgrain size data are tabulated; a plot of log steady state creep rate versus log stress is given; and a graph depicting the subgrain size as a function of stress for NaCl and several other metals is depicted. A plot of representative creep values for polycrystalline sodium chloride tested at 512°C is also given. Results of the tests indicate that the steady state creep rate, $\dot{\epsilon}$, can be expressed by the equation $\dot{\epsilon} = A\sigma^{-Qc/RT}\sigma^{n}$, which has been used to describe dislocation climb and glide controlled creep in metals. In the equation, Qc is the activation energy for creep (73 Kcal/mole), n is the stress component (=7), R is the gas constant, T is the absolute temperature, and σ is the creep stress. L.S.

N66-28075# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
IMPROVEMENT OF CHEMICALLY BONDED CASTABLE ZIRCONIA
C. T. Powers 29 May 1964 59 p
(SM-44672)

An investigation was conducted to improve the strength and thermal shock resistance of chemically bonded castable zirconium oxide. The strength was increased approximately two-fold by (1) optimizing the particle size distribution, (2) optimizing the binder and retarder content, and (3) optimizing the mixing techniques. Author

N66-28283# Polytechnic Inst. of Brooklyn, N. Y.
SURVEY AND FORECAST OF ADVANCED POLYMERIC MATERIALS APPLICABLE TO THE NAVAL SUPPLY SYSTEM, PART I, 1 JUNE–29 OCTOBER 1965
H. F. Mark and S. M. Atlas Bayonne, N. J., Naval Supply Res. and Develop. Facility [1965] 11 p
(Rept.-01-13-001-00-1, Pt. II; AD-631211) CFSTI: HC $1.00/MF $0.50

The report presents a general technological survey of the present state-of-the-art of polymeric science as it is applicable to energy procurement, energy transportation, desalination, and the space program. A forecast is presented with particular emphasis on Naval applicability. Author (TAB)

N66-28270# Litton Systems, Inc., St. Paul, Minn. Applied Science Div.
THERMAL-PHYSICAL PARAMETERS OF MATERIALS Final Report, 21 May 1962–20 May 1965
R. E. Larson and A. R. Kydd Natick, Mass., Army Natick Labs., Jan. 1966 240 p refs *Its* Tech. Rept.-66-3-CM
(Contract DA-19-129-QM-1998)
(C&OM-16; AD-631295) CFSTI: HC $6.00/MF $1.25

Research was performed on the thermal-physical parameters of materials necessary for protection against intense thermal radiation. In the theoretical studies, a simplified model of the fabric-skin system was chosen and the heat flow equations were solved using an explicit finite difference calculation procedure programmed for solution on a Control Data G-15D digital computer. Several sample calculations were compared with results existing in the literature and a limited parameter study was performed with variation of the fabric surface heat transfer coefficients. Fabric test samples were irradiated in an arc image furnace test facility and the heating and degradation processes were qualitatively and quantitatively studied with a Mach–Zehnder interferometer. This instrument provided fabric surface temperature data, heat transfer coefficient information, and a better insight into the chemical processes taking place. Author (TAB)

N66-28298# Polytechnic Inst. of Brooklyn, N. Y.
SURVEY AND FORECAST OF ADVANCED POLYMERIC MATERIALS APPLICABLE TO THE NAVAL SUPPLY SYSTEM, PART I, 1 JUNE–29 OCTOBER 1965
H. F. Mark and S. M. Atlas Bayonne, N. J., Naval Supply Res. and Develop. Facility [1965] 21 p Sponsored by Navy
(Rept.-01-13-001-00-1; AD-631210) CFSTI: HC $1.00/MF $0.50

The report presents a general technological survey of the present state-of-the-art of polymeric science as it is applicable to synthetic fibers, films, plastics, elastomers, adhesives, and materials for surgical implants and high-temperature use. A forecast is presented with particular emphasis on Naval applicability. Author (TAB)

N66-28312# California Univ., Berkeley. Coll. of Engineering.
A FUNDAMENTAL STUDY OF THE MIXING OF PARTICULATE MATERIALS IN CERAMIC PROCESSING Technical Documentary Report, Feb. 1964–Oct. 1965
D. W. Fuerstenau, R. Hogg, R. M. Fulrath, J. A. Pask, and D. S. Cohn Wright-Patterson AFB, Ohio, AF Mater. Lab., Oct. 1965 151 p refs
(Contract AF 33(615)-1140)
(ASD-TDR-62-732, Pt. III; AD-631425) CFSTI: HC $4.00/MF $1.00

The report comprises the results of research on the fundamentals of mixing particulate materials in systems of interest

to ceramic processing. Two principal mechanisms of mixing were delineated, namely macromixing by which groups of particles are transported and micromixing by which individual particles diffuse across boundaries between regions rich in each component. The details of diffusional mixing in an ideal system were studied using a simple barrel mixer. Quantitative theories have been developed to describe the kinetics of this process for the mixing of both major and minor constituents. The mixing of multisized powders was investigated and a correlation found between the degree of mixedness and the bulk volume of the charge. The interaction between dissimilar particles in aqueous, wet-mixing systems was investigated and quantitative expressions were developed to define the stability of such dispersions. Author (TAB)

N66-28372*# National Aeronautics and Space Administration, Washington, D. C.

THE USE OF FOAMED POLYURETHANS FOR MANUFACTURING SOLAR ENERGY COLLECTORS [PRIMENENIYE PENOPOLIURETANOV DLYA IZGOTOVLENIYA KONTSENTRATOROV SOLNECHNOY ENERGII]

S. N. Vil'kova, I. A. Novikova, and D. Alavutdinov Jun. 1966 13 p refs Transl. into ENGLISH from Geliotekhn. (USSR), no. 4, 1965 p 27–30

(NASA-TT-F-10189) CFSTI: HC $1.00/MF $0.50 CSCL 11I

A method for making solar energy collectors from rigid foamed polyurethans lined with mirror-like plastic films is described. Polyurethans used for this purpose were prepared from branched polyesters of dicarboxylic acids and triols or the combination of the latter with diols; the polyesters were combined with aromatic diisocyanates. Foamed polyisocyanates were obtained by combining a polyester resin prepared from glycerol (1.3 moles), sebacic acid (0.5 moles) and adipic acid (0.3 moles) with toluylene diisocyanate in a 10:7 ratio at room temperature; water was used to enhance foaming; the foam was stabilized with OP-7 or OP-10 emulsifier (0.3–0.5%). The foamed plastic obtained had good mechanical properties. Two types of solar energy collectors were built: one-piece paraboloid collectors with a diameter of 280 or 410 mm, and facet collectors mounted from hexagonal facets with sides 55 mm long each. Author

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N66-28840# Joint Publications Research Service, Washington, D. C.

A CHAIN ALGORITHM IN A SYSTEM OF RESIDUE CLASSES

O. D. Zhukov-Yemel'yanov *In its* Studies in Electron. Computers 29 Apr. 1966 p 85–90 refs (See N66-28937 15-08) CFSTI: $5.00

This article deals with an algorithm which may be used to determine the overflow and the sign, also to divide the product of moduli and to check the value of a number in a system of residue classes. Author

N66-27028# Oak Ridge National Lab., Tenn.

MINIMUM BIAS DESIGNS FOR AN EXPONENTIAL RESPONSE

A. R. Manson (Ph.D. Thesis—Va. Polytechnic Inst.) Feb. 1966 178 p refs

(Contract W-7405-ENG-26)

(ORNL-3873) CFSTI: HC $5.00/MF $1.00

For the exponential response $\eta_u = \alpha + \beta e^{\gamma x_u} + \epsilon_u (u = 1, 2, \ldots, N)$ where α and β lie on the real line $(-\infty, \infty)$, and γ is a positive integer; the designs are given which minimize the bias due to the inherent inability of the approximation function $\hat{\eta}_u = \sum_{j=0}^{d} b_j x_u^j$ to fit such a model. Transformation to $\eta_u = \alpha + \beta z_u^{\gamma}$ and $\hat{\eta}_u = \sum_{j=0}^{d} b_j z_u^j$ facilitates the solution for minimum bias designs. The minimum bias designs are obtained for specific values of N with a maximum protection level, $\gamma_d^*(N)$, for the parameter γ and an approximation function of degree d. These designs obtained posses several degrees of freedom in the choice of the design levels of the x_u or the Z_u, which may be used to satisfy additional design requirements. It is shown that for a given N, the same designs which minimize bias for approximation functions of degree one also minimize bias for general degree d, with a decrease in $\gamma_d^*(N)$ as d increases. In fact $\gamma_d^*(N) = \gamma_1^*(N) - d + 1$, but with the decrease in $\gamma_d^*(N)$ is a compensating decrease in the actual level of the minimum bias. Furthermore, $\gamma_d^*(N)$ increases monotonically with N, thereby allowing the maximum protection level on γ to be increased as desired by increasing N. In the course of obtaining solutions, some interesting techniques are developed for determining the nature of the roots of a polynomial equation which has several known coefficients and several variable coefficients. Author (NSA)

N66-27029*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

THE GROUP OF PERMUTATIONS ON 3 LETTERS AND THE PROPER ROTATIONS OF A 3-DIMENSIONAL ORTHOGONAL FRAME

Albert Gluckman 3 Aug. 1965 6 p refs Submitted for Publication

(NASA-TM-X-56895) CFSTI: HC $1.00/MF $0.50 CSCL 12A

Given that M_1, M_2, and M_3 are proper rotations of a three-dimensional orthogonal frame $_3F$, where these unimodular elements of the group SL(3) are multiplied together in six different permutational arrangements; then it is proved that the elements of which the mutually conjugate classes C_1, $C_{(123)}$, and $C_{(132)}$ consist are inner automorphisms of the elements of the alternating group A_3. It is further proved that the automorphisms of C_1, $C_{(123)}$, and $C_{(132)}$ correspond to ψ, where the permutations σ_1, σ_2, and σ_3 are similar, respectively, to $M_1M_2M_3$, $M_2M_3M_1$, and $M_3M_1M_2$. D.T.

N66-27108# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.

A NOTE ON INVERTING THE R-MATRIX

T. Watanabe Jan. 1966 28 p refs

(Contract AT(10-1)-205)

(IDO-17142) CFSTI: HC $2.00/MF $0.50

The procedure of rank annihilation is applied to the inversion of the R-matrix. It is shown that the method inverts the R-matrix in a way similar to the method of Thomas but that it leads to a different form. The advantage of this particular method and some approximations are discussed. Author (NSA)

N66-27184*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TRANSIENT RESPONSE FROM THE LYAPUNOV STABILITY EQUATION
William G. Vogt Washington, NASA, Jun. 1966 24 p refs
(NASA-TN-D-3430) CFSTI: HC $1.00/MF $0.50 CSCL 12A

For a certain class of linear and nonlinear asymptotically stable systems and a certain class of Lyapunov functions, estimates of transient response are related to the real parts of the characteristic values of the system matrix of the linear approximation. The transient response is derived and a formula is given to choose the Lyapunov functions such that the transient responses approach these limiting values as closely as desired. Author

N66-27303# American Mathematical Society, New York.
LECTURE NOTES PREPARED IN CONNECTION WITH THE SUMMER INSTITUTE ON ALGEBRAIC GROUP AND DISCONTINUOUS SUBGROUPS
[1965] 466 p refs Inst. held at Colo. Univ., Boulder, Jul. 5–Aug. 6, 1965
(Grants Nonr(G)00055-65; NSF GP-3983)
(AD-620039) CFSTI: HC $7.70/MF $2.00

The principal developments in the arithmetic aspects of algebraic groups are included in the following five major topics: Algebraic linear groups and arithmetic groups, including a survey of the structure and classification theory over arbitrary fields, groups over Z, the maximal compact subgroups of p-adic groups, and reduction theory for arithmetic groups. Adelization, Tamagawa numbers, the Siegel-Weil formula, Galois cohomology, and approximation theorems. Automorphic forms, the spectral decomposition of L-squared (G/gamma), Eisenstein series, interpretation of a Ramanujan conjecture. The compactification and projective imbedding of arithmetically defined quotients of bounded symmetric domains, partial desingularization of the compactification, fiber systems of polarized abelian varieties, fields of moduli, zeta-functions, theta-functions, L-functions, Fourier–Jacobi series, symplectic representations. Vector-valued cohomology and rigidity theorems. Author (TAB)

N66-27414# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
LINEAR ESTIMATION OF THE LOCATION AND SCALE PARAMETERS OF THE WEIBULL AND GAMMA PROBABILITY DISTRIBUTIONS BY THE USE OF ORDER STATISTICS
Thomas A. Musson (M.S. Thesis) Dec. 1965 244 p refs
(GRE/MATH/65-9; AD-630811) CFSTI: HC $24.00/MF $1.25

The least squares method of linear estimation can be applied to order statistics of certain continuous distributions. With the shape parameter known, this method is applied to the estimation of the location and scale parameters of the Weibull and Gamma distributions. Coefficients of estimation using the first M-order statistics and the best two-order statistics from a small sample, were calculated and tabled. For the Weibull distribution, the tabled coefficients are for the shape parameter equal to 0.5 (.25)2.0 (0.5)4.0 with a sample size of 2 (1)15 for the two-order-statistic estimators and a sample size of 2 (1)10 for the M-order-statistic estimators. For the Gamma distribution, the shape parameter equals 1 (1)6 and the sample size equals 2 (1)15 for both estimators. Author (TAB)

N66-27416# Wisconsin Univ., Madison. Mathematics Research Center.
A DIALYSIS SYSTEM WITH ONE ABSORBING AND ONE SEMI-REFLECTING STATE
Marvin A. Kastenbaum Feb. 1966 22 p refs
(Contract DA-11-022-ORD-2059)
(MRC-628; AD-630754) CFSTI: HC $2.60/MF $0.50

The random walk between an absorbing and a reflecting or semi-reflecting barrier has been discussed in the literature. Indeed, a biological example of such a random walk, arising from a system of countercurrent dialysis, was described by this author. In this earlier paper a technique was suggested for obtaining the probability of being in a specific state after a given number of transitions, if the probability is unity of being in the reflecting state at time zero. The present paper extends this technique to yield the full matrix of higher transition probabilities. Author (TAB)

N66-27419# Wisconsin Univ., Madison. Mathematics Research Center.
A GENERALIZED INVERSE-ϵ ALGORITHM FOR CONSTRUCTING INTERSECTION PROJECTION MATRICES, WITH APPLICATIONS
L. Duane Pyle Feb. 1966 34 p refs
(Contract DA-11-022-ORD-2059)
(MRC-604; AD-630538) CFSTI: HC $2.00/MF $0.50

Given k linear manifolds and corresponding perpendicular projection matrices, a closed formula is derived for the perpendicular projection matrix. The derivation uses results taken from the theory of generalized inverses together with an application of Wynn's Epsilon–Algorithm to a convergent sequence of matrices. A variant of this formula is then used in solving arbitrary complex linear systems by iteration and in computing generalized inverses; the latter application provides a solution to least squares linear regression problems. Author (TAB)

N66-27509# Oak Ridge National Lab., Tenn.
THE MINIMUM SIGNIFICANT NUMBER OF SUCCESSES IN A BINOMIAL SAMPLE
Marvin A. Kastenbaum and K. O. Bowman Feb. 1966 68 p refs
(Contract W-7405-ENG-26)
(ORNL-3909) CFSTI: HC $3.00/MF $0.75

In the field of sampling inspection one often wishes to know the smallest number of successes (or failures), c, in n independent Bernoulli trials such that $\Sigma_{r=c}^{n} \binom{n}{r} p^r(1-p)^{n-r} \leq \alpha$, where p is the probability of successes in a single trial, and $0 \leq \alpha \leq 1$ is a specified level of significance. Numerical tables were calculated to provide minimum values of c, for a given n, p, and α. Values of c are given for all combinations of n=1(1)200, p=0.01 (0.01) 0.99, and α=0.01, 0.05, 0.10. NSA

N66-27578# Stanford Univ., Calif. Dept. of Statistics.
FINITE QUEUES IN SERIES WITH EXPONENTIAL OR ERLANG SERVICE TIMES
Frederick S. Hillier and Ronald W. Boling 18 Mar. 1966 38 p refs
(Contract Nonr-225(53))
(TR-88; AD-629308) CFSTI: HC $3.60/MF $0.50

This paper considers a queueing system consisting of N service channels in series where each channel has an exponential or Erlang holding time and (except for the first channel) a finite queue, and where the input process is such

that the first queue is never empty. The measures considered are the steady-state mean output rate and mean number of customers in the system (excluding the first queue). First, a procedure is described for obtaining these measures which is relatively efficient computationally. Second, an exceptionally efficient procedure is developed for approximating the mean output rate for the case of exponential holding times. It is demonstrated that this procedure provides an excellent approximation for most cases and that it is computationally feasible for large problems. Third, extensive new numerical results are obtained. Author (TAB)

N66-27618# Mitre Corp., Bedford, Mass.
METRIZED SCHEDULING RELATIONS AND APPLICATIONS
J. F. Rial Bedford, Mass., AFSC, Electron. Systems Div., Mar. 1966 58 p refs
(Contract AF 19(628)-5165)
(ESD-TR-66-67; MTR-69; AD-631289) CFSTI: HC $3.00/MF $0.75

The definitions of scheduling relations previously presented by the author are extended in this report to allow the translation of a relation net into an exact schedule. Time conditional conflicts in scheduling relation nets are detected and resolved by operating on extended versions of the bilateral implication and truth tables. Author (TAB)

N66-27619# Parke Mathematical Labs., Inc., Carlisle, Mass.
SHAPE RECOGNITION, PRAIRIE FIRES, CONVEX DEFICIENCIES AND SKELETONS Scientific Report No. 1
Lorenzo Calabi and William E. Hartnett Feb. 1966 24 p refs
Its Rept.-574-SR-1
(Contract AF 19(628)-5711)
(AFCRL-66-167; AD-631279) CFSTI: HC $2.60/MF $0.50

To every closed subset A of the Euclidean plane is associated its convex deficiency D and its skeletal pair (S, q). Extending a known result (A is convex iff $S=D$ iff $D=0$) one can prove: different sets have the same skeletal pair iff they have the same convex deficiency. Several other results are presented concerning the correspondence $A \rightarrow (S, q)$ and the properties of S and q. The relevance of these notions and theorems for a mathematical model of visual perception is emphasized. Author

N66-27678# Pennsylvania Univ., Philadelphia.
DIFFERENTIABLE TRANSFORMATION GROUPS ON HOMOTOPY SPHERES
Chung-Tao Yang and D. Montgomery [1966] 26 p refs
Rept.-3
(Contract DA-31-124-ARO(D)-123)
(AROD-2056-16; AD-631373) CFSTI: HC $1.00/MF $0.50

Techniques and results of differentiable topology are employed in the study of differentiable transformation groups. This paper differs from recent works with the same objective in that pasting techniques rather than bordism theory are used. Author (TAB)

N66-27679*# Northwestern Univ., Evanston, Ill. Dept. of Geography.
A PROBABILITY LAW OBTAINED BY COMPOUNDING THE POISSON AND HALF-NORMAL PROBABILITY LAWS Technical Report No. 4
Michael F. Dacey Dec. 1965 10 p refs
(Contract Nonr-1228(35))
(NASA-CR-75674; AD-631725) CFSTI: HC $1.10/MF $0.50
CSCL 12A

A discrete probability law is considered for a probability mass function where the parabolic cylinder function and the complementary error function are given. This probability law is obtained by assuming that the parameter of a Poisson variable is distributed according to the half-normal probability law. A recursive relation for the individual probability term and the rth factorial moment are obtained. A small table of probability terms is included. Author

N66-27697 California Univ., Berkeley. Operations Research Center.
BLOCK TRIANGULARIZATION OF MULTI-STAGE LINEAR PROGRAMS
Romesh Saigal Mar. 1966 42 p refs
(Contract Nonr-222(83); Grants NIH GM-9606-05; NSF GP-4593)
(ORC-66-9; AD-631810) CFSTI: HC $2.00/MF $0.50

In this work a variant of the Revised Simplex Method is developed for solving a multistage linear program in which the output of one stage is an input to the next. The method is devised to use the special staircase structure of the original basis. It essentially reduces this basis into a block triangular working basis by a set of elementary column operations. The use of the working basis in place of the original now involves the inversion of the diagonal blocks which are considerably smaller in size (of the order of 1/nth of the original in an n-stage problem). Thus the work involved and the storage required is considerably less. An efficient procedure is developed for updating the working basis. The method consists of interchanging the dropping column to the last stage effected by the pivot on a diagonal block. The updated diagonal blocks are then obtained by a cascade pivot in which the dropping column of each stage is entered into the next until the column leaving the basis is dropped. Author (TAB)

N66-27710# Michigan State Univ., East Lansing. Dept. of Statistics.
A PAIR OF COMPLEMENTARY THEOREMS ON CONVERGENCE RATES IN THE LAW OF LARGE NUMBERS
C. C. Heyde (Sheffield Univ.) and V. K. Rohatgi Dec. 1965 20 p refs
(Contract Nonr-2587(05))
(MSU-RM-153-VKR-1; RR-6/VKR-1; AD-631619) CFSTI: HC $1.00/MF $0.50

Let χ_i, $i = 1.2.3. \ldots$, be a sequence of independent and identically distributed random variables with law L(X) and write

$$S_n = \sum_{i=1}^{n} \chi_i.$$

Take $0 < r < 2$. The Kolmogorov–Marcinkiewicz strong law of large numbers (Loève (6), 243) has the following statement: If $E|X|^r < \infty$, then $n^{-1/r}(S_n - nc_r) \xrightarrow{a.s.} 0$ with $c_r = 0$ or EX according as $r < 1$ or $r \geq 1$. Conversely, if $n^{-1/r}(S_n - nc_r) \xrightarrow{a.s.} 0$ then $E|X|^r < \infty$ ("a.s." denotes almost sure convergence). It is our purpose in this paper to study the rates of convergence of $Pr(n^{-1/r}|S_n - nc_r| > \epsilon)$ and

$$Pr(\sup_{k \geq n} k^{-1/r}|S_k - kc_r| > \epsilon)$$

to zero for arbitrary $\epsilon > 0$. Author

N66-27732*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A REVIEW OF SOME EXISTING LITERATURE CONCERNING DISCONTINUOUS STATE VARIABLES IN THE CALCULUS OF VARIATIONS
Rowland E. Burns Washington, NASA, Jun. 1966 61 p refs
(NASA-TN-D-3450) CFSTI: HC $3.00/MF $0.75 CSCL12A

The problem of determining optimal trajectories for problems with discontinuous state variables has been treated by a few authors in rather esoteric papers. This paper summarizes the contents of two of these in a fairly detailed discussion. An attempt has been made to develop explicitly those relationships which are not contained in material dealing with the case of continuous state variables. The essential feature of the discussion is a transformation from a set of state variables with points of discontinuity to a set of new variables which, though greater in number, are continuous. The necessary conditions of Euler, Weierstrass, and Clebsch, along with the transversality conditions, are discussed in the transformed problem; the results are rewritten in the original variables. The bulk of material covered assumes that the magnitudes of the discontinuities are known a priori, but the case of unknown discontinuities is treated in the latter portion of the paper.
Author

N66-27747*# Emory Univ., Atlanta, Ga.
GENERAL AND ALMOST GENERAL PERIODIC FUNCTIONS
Tomlinson Fort May 1966 31 p refs
(Grant NsG-545)
(NASA-CR-74555) CFSTI: HC $2.00/MF $0.50 CSCL 12A

Elementary mathematical methods are proposed to solve a problem in implicit functions, in which f(z) is given to determine h(z). A difference equation with varying difference interval is formulated which is nonhomogeneous and of the first order. The theorem establishes the existence of a general periodic function with period h(x) which is differentiable. Equations are given to define almost-general periodic functions, and it is pointed out that not all almost-general periodic functions are uniformly continuous over their domain of definition. Invariance under fundamental operations is also examined, and mean values are considered. Fourier constants are used to show that in a series of alternating signs, each term is in absolute value less than the absolute value of the term immediately preceding it.
M.G.J.

N66-27760# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.
A NEW LOOK AT THE NUMERICAL INTEGRATION OF ORDINARY DIFFERENTIAL EQUATIONS
H. S. Rahme Feb. 1966 20 p refs
(RM-310)

Unlike well known numerical integration methods for differential equations, the technique presented herein seeks maximum accuracy at each time step without violating stability. The coefficients of the integrating algorithm derived in this report are expressed in terms of the function to integrate. This property permits a more accurate point by point integration of nonlinear differential equations. For differential equations having coefficients such that the previous methods require an unduly small interval of integration to preserve stability, the proposed method permits, because of its large stability region, an appreciable increase in the interval of integration. Like many other predictor corrector methods, this technique offers an adequate means for controlling the step size during the course of the integration.
Author

N66-27762# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.
ON THE CLASSIFICATION OF SINGULAR AND NONSINGULAR EXTREMALS FOR THE PONTRYAGIN MAXIMUM PRINCIPLE
Joseph C. Dunn Feb. 1966 59 p refs
(RE-241)

This paper extends the relationship existing between certain partial derivatives of the pseudo-Hamiltonian function, and the corresponding partial derivatives of the maximized pseudo-Hamiltonian, to the point where it can be used to characterize singular and nonsingular extremals for the Pontryagin maximum principle. A general scheme for classifying these objects is proposed, and considerable effort is directed at developing the properties of the non-singular extremal. In addition, a comparison is drawn between the general definition of singularity, and a specialized definition already existing in the literature. Finally, brief consideration is given to the computational problems which may arise in connection with the approximation of the various kinds of extremal via numerical integration procedures.
Author

N66-27772# Eidgenossische Technische Hochschule, Zurich (Switzerland).
EXACT AND APPROXIMATE SOLUTIONS OF MANY-GROUP TRANSPORT EQUATIONS IN PLANE GEOMETRY [EXAKTE UND ANGENAHERTE LOSUNGEN DER MEHR-GRUPPEN-TRANSPORTGLEICHUNG IN EBENER GEOMETRIE]
Kurt Zumbrunn (Ph.D. Thesis) 1965 92 p refs In GERMAN
Its Rept.-3559
(EIR-72)

The transport equations of the multigroup type were investigated using the Case method to determine how exact solutions of the transport equation could be found for simple problems. The methods used by Zelazny and Kuszell were simplified; the problem, to develop a function with respect to the complete system of the eigensolutions of the transport equation, can be solved explicitly because of the limitation to the multigroup equations. Approximate solutions of the same transport equation were derived in the P_n formalism (development of the angular dependent part of the neutron flux by Legendre polynomials) and some analogies to the exact Case method were shown. The solutions were then applied to the numerical solution of the Milne problem. Heavy ideal gases were used as the scattering model. The results found agree quantitatively with previous studies.
Author (NSA)

N66-27802# Naval Research Lab., Washington, D. C.
BRIEF TABLE OF RING FUNCTIONS (TOROIDAL HARMONICS) Interim Report
Evan B. Wright and Paul I. Peterson 22 Mar. 1966 15 p refs
(NRL-MR-1679; AD-630834) CFSTI: HC $1.00/MF $0.50

This brief table gives six-figure values of some of the ring functions (Legendre functions of integral order and half-integral degree) and their derivatives for some selected values of the argument. These functions are solutions of Laplace's equation in toroidal coordinates.
TAB

N66-27888# Case Inst. of Tech., Cleveland, Ohio. Operations Research Group.
THE DECOMPOSITION PRINCIPLE IN ENGINEERING PROBLEMS: TOWARDS A MULTI-LEVEL CONCEPT OF PROBLEM-SOLVING

Hamilton A. Chase and S. S. Sengupta [1961] 19 p refs (Contracts Nonr-1141(11); Nonr-1141(12))
(TM-14; AD-630942) CFSTI: HC $1.60/MF $0.50

The principal result of this report is a demonstration that systems of ordinary differential equations of engineering that are too large for the available computers can be solved by a principle of decomposition. It is shown that the systems of resulting subproblems are members of a larger class of problems. The properties of this class are investigated and conditions stated under which the solutions of the subproblems converge to those of the original problem. A measure of the interaction between the subproblems is suggested for a subsequent investigation. Author (TAB)

N66-27964*# Stanford Univ., Calif. Dept. of Statistics.
TWO-ACTION COMPOUND DECISION PROBLEMS Technical Report No. 87
M. V. Johns, Jr. 11 Mar. 1966 36 p refs Sponsored by NASA (Contract Nonr-225(53))
(NASA-CR-75532) CFSTI: HC $2.00/MF $0.50 CSCL 12B

Asymptotically optimal methods are given for deciding between two alternative actions in situations such as those occurring in routine lot by lot acceptance sampling where essentially the same decision problem arises repeatedly and accumulated past information can be used to advantage. A linear cost structure is used and no assumptions are made concerning the existence of a priori probability distributions of the relevant unknown parameters. Procedures are given which take advantage of empirical dependencies appearing in the sequences of unknown parameter values. Rates of convergence to optimality are obtained. Author

N66-28009*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
AN ITERATIVE METHOD FOR COMPUTING THE GENERALIZED INVERSE OF A MATRIX
H. P. Decell, Jr. and S. W. Kahng (Lockheed Electron. Co.) Washington, NASA, Jun. 1966 18 p refs
(NASA-TN-D-3464) CFSTI: HC $1.00/MF $0.50 CSCL 12A

The purpose of this paper is to present extensions of results announced by A. Ben-Israel concerning an iterative method for computing the generalized inverse of an arbitrary complex matrix. Ben-Israel announced his results without proof; at about the same time, the authors of this paper independently derived very similar results with more relaxed hypotheses. These similar results are presented with proof, together with comments pertaining to the Ben-Israel theorem. Author

N66-28044*# Research Triangle Inst., Durham, N. C.
DEVELOPMENT OF RELIABILITY METHODOLOGY FOR SYSTEMS ENGINEERING. VOLUME III: THEORETICAL INVESTIGATIONS—AN APPROACH TO A CLASS OF RELIABILITY PROBLEMS Final Report
M. R. Leadbetter and J. D. Cryer (Ph.D. Thesis—N. C. Univ.) Apr. 1966 97 p refs
(Contract NASw-905)
(NASA-CR-75672) CFSTI: HC $3.00/MF $0.75 CSCL 12A

This report is concerned with certain random quantities derived from a continuous time stochastic process X(t). Particular interest is centered on the number of crossings of certain barriers by the sample functions of X(t) and other closely related random variables. Such quantities are of interest in reliability theory both in their own right as performance measures and because they can provide bounds on certain probabilities. Also considered are certain random variables related to excursions outside of given barriers. The first two moments of these variables are given and it is noted that Chebyshev-type bounds on probabilities of interest can be obtained from these moments. Some discussion is devoted to crossings and excursions outside two-sided barriers. Author

N66-28110# Joint Publications Research Service, Washington, D. C.
A GENERAL APPROACH TO SOLUTIONS OF LINEAR PROGRAMMING PROBLEMS WITH BLOCK STRUCTURES
E. G. Gol'shtein 23 May 1966 13 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 166, no. 5, 1966 p 1062–1065
(JPRS-35655; TT-66-32090) CFSTI: $1.00

Considerations are given to the linear programming problem (1) $(C,X)\rightarrow\max$, (2) $AX=B$, (3) $A^1X=B^1$, and (4) $X\geq 0$. Here A and A^1 are m x n and m_1 x n matrices, respectively, while B, B^1, and C are m, m_1, and n-dimensional vectors, respectively. It is assumed that the matrix A^1 has a special structure (e.g., is block diagonal or a transport matrix), which substantially simplifies analysis of a linear problem with conditions (3) and (4). A rather general approach to the construction of block programming methods is presented that has a natural geometric interpretation and is associated with an attempt to find an estimate vector for conditions (2). R.N.A.

N66-28190# Deutsche Forschungsanstalt für Luft- und Raumfahrt, Brunswick (West Germany). Institut für Flugmechanik.
A METHOD TO CREATE CONDITIONS FOR THE APPEARANCE OF OPTIMAL, SINGULAR CONTROLS WITH LINEAR AUTONOMOUS PROBLEMS OF VARIATIONS [EIN VERFAHREN ZUR AUFSTELLUNG VON BEDINGUNGEN FUER DAS AUFTRETEN OPTIMALER, SINGULAERER STEUERUNGEN BEI LINEAREN, AUTONOMEN VARIATIONSPROBLEMEN]
O. Narjes and F. Henschel Dec. 1965 35 p refs In GERMAN; ENGLISH summary
(DLR-FB-65-67) CFSTI: HC $2.00/MF $0.50

In further brief explanation on completed methods of calculus of variations, on the maximum principle and the optimization method by Miele, the authors demonstrate how to obtain by means of such methods necessary and for particular cases sufficient conditions for the appearance of singular controls. Resulting from considerations of plausibility, a new method is outlined which enables them to specify conditions for the appearance of optimal singular controls; examples are cited from the field of flight dynamics. Author

N66-28304# Aerospace Research Labs., Wright-Patterson AFB, Ohio. Applied Mathematics Research Lab.
DETERMINANTAL EVALUATION OF EIGENVALUES
Donald S. Clemm Jan. 1966 16 p
(ARL-66-0017; AD-631388) CFSTI: HC $1.60/MF $0.50

The numerical determination of the eigenvalues of a matrix consists of two phases; one, the isolation of the eigenvalues and, two, the calculation proper. The report concerns itself with the second phase and assumes that the first, probably more difficult, phase has been accomplished. The method presented requires the lower and upper bounds of the distinct real eigenvalues of a real matrix to be known beforehand. By an iterative procedure, involving the evaluation

of determinates, the lower bound is increased and/or the upper decreased until agreement is achieved between them to a specified number of digits. Multiple eigenvalues can not be determined by this method. All eigenvalues are obtained to the same number of significant figures, which should be especially helpful when working with a matrix whose eigenvalues have very wide dispersion. A discussion of scaling is included which is applicable to many matrix problems, regardless of the method used to get numerical results. A table appears which compares the results obtained from using this method with those of another, when both procedures were applied to a specific problem. A Fortran IV computer program has been written embodying the principles contained herein. Author (TAB)

N66-28323# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

ESTIMATION OF THE SCALE PARAMETER OF THE GAMMA DISTRIBUTION BY USE OF L ORDER STATISTICS

Thomas David Hill (M.S. Thesis) Dec. 1965 209 p refs (GRE/MATH/65-5; AD-630810) CFSTI: HC $20.30/MF $1.25

A technique is developed for estimating the scale parameter of a gamma distribution with known shape parameter using 'L' order statistics. A best linear unbiased estimate may be computed by applying tabulated multipliers to 'L' of the first 'M' ordered observations. The variance of an estimator using all 'M' of the observations and the efficiencies of the L-order-statistic-estimators are given. Tabled ranges include shape parameters of $\alpha = 1(1)6$ for sample sizes of $N = 1(1)15$. A method of obtaining the multipliers when the shape parameter is not an integer is also shown. Estimation by the use of L-order-statistics is particularly useful, for highly efficient estimators relative to the M-order-statistic-estimators may be obtained with a significant reduction in computational effort. Author (TAB)

N66-28324# Case Inst. of Tech., Cleveland, Ohio. Operations Research Group.

THE DECOMPOSITION PRINCIPLE IN ENGINEERING PROBLEMS: TOWARDS A MULTI-LEVEL CONCEPT OF PROBLEM SOLVING

H. A. Chase and S. S. Sengupta [1962] 23 p refs (Contracts Nonr-1141(11); Nonr-1141(12)) (TM-16; AD-630943) CFSTI: HC $2.60/MF $0.50

In a previous report it was shown that a large system of differential equations could be decomposed into smaller groups (called sub-problems) such that the solutions of the subproblems converged to the solution of the original system. It was also shown that the decomposition was most effective when the original problem was decomposed along the boundaries of weakest interaction in terms of the Lipscitz constants. This last fact, however, is a desirable but not essential condition. The major purpose of the present report is to develop certain techniques which will facilitate the application of the decomposition principle as stated in the previous report. The techniques fall into two categories: (a) those that help indicate how the grouping may be done in a natural and efficient manner, and (b) those that lead to a prior simplification of the original problem before the variables are grouped. Techniques of the first category make use of what has been called directed graphs; those of the second category concentrate on the various types of linearization. Author (TAB)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N66-26900# Joint Publications Research Service, Washington, D. C.

TRANSLATIONS FROM METEOROLOGIYA I GIDROLOGIYA (METEOROLOGY AND HYDROLOGY), NO. 2, FEBRUARY 1966

24 Mar. 1966 71 p refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 2, Feb. 1966 p 3-12, 33-38, 48-49, and 51-64 (JPRS-34716; TT-66-31155) CFSTI: $3.00

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N66-26901# Joint Publications Research Service, Washington, D. C.

THE ECONOMIC USEFULNESS OF FORECASTS

N. A. Bagrov *In its* Transl. from Meteorol. i Gidrolog., No. 2, Feb. 1966 24 Mar. 1966 p 1-14 refs (See N66-26981 15-20) CFSTI: $3.00

A method of hydrometeorological forecasting based on statistical probability was investigated. The predicted phenomenon is broken down into a finite number of phases, and the conjugate matrix is discussed. It is emphasized that more than one weather element must be used. The method is illustrated with several examples. The unreliability of predicting thunderstorms is examined. Only the general forecasts intended for the public at large were investigated. Cost considerations are mentioned. N.E.N.

N66-26903# Joint Publications Research Service, Washington, D. C.

OPERATIONAL FEATURES OF THE M-47 AND M-49 METEOROLOGICAL STATIONS

K. I. Zarubin *In its* Transl. from Meteorol. i Gidrolog., No. 2 Feb. 1966 24 Mar. 1966 p 25-29 (See N66-26900 15-20) CFSTI: $3.00

The care required in the assembly and maintenance of the wind velocity and direction sensor unit are discussed.

The proper positioning and tightening of the screw regulating the vane for accurate readings are described. The difficulties incurred by the loosening of the coupling between the selsyn and the axis of the selsyn are reported. The control of the rotation angle of the blades is mentioned. Recommendations to eliminate these shortcomings without interruption of observations include: using a second reinforcing screw; using more durable metal; introducing a rigid fixed position of the vane blades; and changing the configuration of the fitted part of the selsyn axis from a cylinder to a square. N.E.N.

N66-28957# Joint Publications Research Service, Washington, D. C.

A STRONG ELECTRIC FIELD RADIOSONDE AND ANALYSIS OF RESULTS OBTAINED IN THUNDERCLOUDS

Chen Yuan, Pan-t'ang Chiang, Li-hsin Jen, Shih-chien Chou, and Ta-chou Chen *In its* Transl. on Communist China's Sci. and Technol., 13 May 1966 p 1-14 refs Transl. into ENGLISH from Ch'i-Hsiang Hsueh-Pao (Peking), v. 35, no. 4, Nov. 1965 p 440-448 (See N66-28956 15-34) CFSTI: $3.00

A thundercloud radiosonde with an inductor made of pointed conductor wire and an AM-FM telemetering circuit was constructed. The system uses two 2P1P tubes—one in the frequency modulator and another for the 85 MHZ transmitter. An anti-interference circuit is employed for the ground receiving installation, which discriminates against disturbances caused by non-overhead lightings. The instrument was tested five times and the results were tentatively analyzed. Author

N66-28961# Chicago Univ., Ill. Dept. of the Geophysical Sciences.

USE OF WET-BEAM DOPPLER WINDS IN THE DETERMINATION OF THE VERTICAL VELOCITY OF RAINDROPS INSIDE HURRICANE RAINBANDS

Tetsuya Fujita, Peter G. Black, and Arthur G. Loesch Apr. 1966 36 p refs

(Grant Cwb-WBG-41)

(RP-58)

In order to solve the problem of the zero Doppler winds that occur during traverses through intense hurricane rainbands, a complete examination of the processes of wind-velocity determination by a Doppler wind system was attempted. It was revealed that the measured frequency shifts depend not only upon the degree of beam attenuation due to the raindrops but also upon the modes of frequency-shift determination by the frequency tracker. The separation of the return signals from the ground and the precipitation determines the three tracking modes called linear, transient, and locking modes. Both transient- and locking-mode tracking usually occurs in hurricanes, resulting in the determination of either ground or true air velocities by a Doppler system. Because the differential frequency shift determines the Doppler velocity, the Doppler winds can be determined with extreme accuracy when either front or rear beams lock onto the raindrops while the other beams keep measuring the frequency shift of the signal from the ground. Winds thus determined give a median-intensity wind which is not at all affected by the tracking mode. Author

N66-28970# Environmental Science Services Administration, Washington, D. C.

PROJECT STORM CLOUD—AN AIRCRAFT-SATELLITE CASE STUDY OF AN EAST COAST CYCLONE. PART I: DESCRIPTIVE ASPECTS

E. Paul Mc Clain and Linwood F. Whitney, Jr. Dec. 1965 55 p refs *Its* Meteorol. Satellite Lab. Report No. 35

Project Storm Cloud was designed to make extensive use of meteorological research aircraft and meteorological satellites in case studies of cyclones developing near the Atlantic Coast of the United States. Other data collections involving special pilot reports, rawinsonde flights, and radar scope photography were arranged for also. The satellite photographs enabled detection of, or drew attention to, many features of the storm system that would neither have been anticipated from synoptic models nor detected with conventional observations. Nearly simultaneous satellite photographs, aircraft time-lapse cine film, and radar scope photographs enabled a synergistic approach to the synoptic meteorological analysis. The satellite pictures provided the broad-scale framework about which the other forms of data could be organized, as well as giving information about the nature of individual cloud systems and their relation to one another. The more restricted but highly detailed data provided by the research aircraft, on the other hand, enabled better interpretive use of the satellite pictures. Author

N66-28976# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.

LARGE-SCALE VERTICAL MOTION AND SATELLITE CLOUD PHOTOGRAPHS Final Report

Frederick Sanders Dec. 1965 92 p refs

(Contract CWB-10843)

TIROS cloud photographs and fine-scale quasi-geostrophic calculations of vertical motion are used in an attempt to gain understanding of the evolution of large-scale cloud masses and to explore the usefulness of the pictures in diagnosis of the vertical motions. Horizontal and vertical motions are found to be of roughly equal importance in the evolution of cloud patterns, except in the early phases of the storm, when the latter predominates. Cloud vortices occur in a variety of large-scale motion environments and seem to depend on fine-scale variations of motion and moisture structure which escape detection in conventional sounding networks. A cloud vortex is a sufficient but not a necessary criterion for nearby coexistence of a closed circulation or vorticity maximum throughout a substantial depth of the troposphere. Quasi-geostrophic theory yields at least qualitatively realistic vertical motions even in application to systems of smaller scale than can be justified *a priori*. Author

N66-28989# Joint Publications Research Service, Washington, D. C.

SOME RESULTS OF USE OF RADAR OBSERVATIONS FOR EVALUATING THE SUCCESS OF ARTIFICIAL MODIFICATION OF CONVECTIVE CLOUDS

V. A. Korzhov 2 Jun. 1966 9 p refs Transl. into ENGLISH from Inform. Byul. Geofiziki i Astron. (Kiev), no. 8, 1965 p 103-105

(JPRS-36792; TT-66-32227) CFSTI: $1.00

A method for processing radar observations is presented which gives criteria for detecting artificial precipitation centers and, thereby, makes it possible to evaluate the success of artificial cloud modification. In order to make this evaluation, consideration was given to cases for which the radar coordinates of the aircraft were known at the time of cloud seeding. In 11.5% of the cases, seeding led to the formation of an earlier unobserved radar echo in and under the cloud; in 14% of the cases no radar echoes were discovered; in 38% of the

cases, seeding occurred with radar echoes at the time or prior to the seeding; and in 7.5% of the cases cloud seeding exactly coincided with the formation of radar echoes. M.W.R.

N66-27304# Holman (John F.) and Co., Inc., Washington, D. C.
THE METEOROLOGICAL PROBLEM OF ELECTRONIC MEASUREMENT OF DISTANCE [DAS METEOROLOGISCHE PROBLEM DER ELEKTRONISCHEN ENTFERNUNGSMESSUNG]
J. Mitter Ft. Belvoir, Va., Army Engr. Res. and Develop. Labs., Feb. 1966 27 p refs Transl. into ENGLISH from Acta Tech. Acad. Sci. Hung., Ser. Geodaet. Geophys. (Budapest), v. 5, no. 1-2, 1964 p 159–178
(ERDL-T-1819-66; TT-66-60477; AD-627722) CFSTI: HC $2.00/MF $0.50

After a brief characterization of the presently employed electro-optical and electronic methods of measuring distance and the general conditions of propagation of their carrier waves in the atmosphere, the determination of the mean rate of propagation of the carrier waves is discussed. The latter is dependent on the possibility of determining the prevailing refraction coefficient which is a function of locus of the meteorological conditions along the wave path. The basic problem for light waves and microwaves lies in the possibility of determining the accurate mean temperature and/or, for the decimeter and centimeter waves, also in the possibility of determining the mean vapor pressure. So far, the determination of the meteorological data has been made only at the termini of the respective distances and close to the ground. It is based on the assumption of a practically linear structure of the meteorological field for all elements in the area of measurement. The structure of the temperature by day and by night both close to the ground and in the 'free' atmosphere and the additional influences due to motion of the air, topography and ground cover are discussed. Author (TAB)

N66-27410# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
THE EVOLUTION OF CUMULUS CLOUDS: A NUMERICAL SIMULATION AND ITS COMPARISON AGAINST OBSERVATIONS Final Report
F. W. Murray and A. B. Hollinden Mar. 1966 149 p refs
(Contract Nonr-4715(00)(X))
(SM-48372; AD-630660) CFSTI: HC $14.60/MF $1.00

Atmospheric thermal convection on the cumulus scale is investigated by numerical solution of the appropriate equations of hydrodynamics and thermodynamics. Initial conditions are based on real or synthetic atmospheric soundings. The one case of synthetic data studied was included to compare the model with a previous simpler model. The other cases are based on actual tropical maritime soundings, two of which correspond with conditions studied by the Naval Research Laboratory by means of instrumented aircraft. The simulated clouds are found to agree in many respects with the real clouds, and in those details in which they disagree possible explanations in terms of limitations of the model and of techniques of aerial observation are discussed. Among the features discussed in some detail are eddy transfer mechanism and the effects of multiple impulses. Recommendations are made for further improvement to the model and for additional field observations. It is concluded that this type of numerical study combined with aerial observation of real clouds offers a very effective method for the study of cumulus dynamics. Author (TAB)

N66-27425# American Meteorological Society, Boston, Mass.
RADAR ECHO CHARACTERISTICS OF CLOUDS [RADIOLOKATSIONNYE PRIZNAKI KHARAKTERA OBLACHNOSTI]
R. V. Ignatova, V. A. Petrushevskii, and E. M. Sal'man Bedford, Mass., AFCRL, Jan. 1966 16 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 173, 1965 p 26–33
(Contract AF 19(628)-3880)
(T-R-536; TT-66-60909; AD-630675) CFSTI: HC $1.00/MF $0.50

The article treats the quantitative characteristics of the radar echo in various forms off clouds. It is shown that the vertical profile of the reflectivity can be used as one of the criteria for determining the form of clouds. Author (TAB)

N66-27430# American Meteorological Society, Boston, Mass.
SOME RESULTS OF RADAR MEASUREMENT OF PRECIPITATION PER UNIT AREA [NEKOTORYE REZUL'TATY IZMERENII KOLICHESTVA OSADKOV PO PLOSHCHADI RADIOLOKATSIONNYM METODOM]
L. M. Volynets, M. L. Markovich, and V. M. Muchnik Bedford, Mass., AFCRL, Feb. 1966 16 p refs Transl. into ENGLISH from Tr. Ukr. Nauchn.-Issled. Gidrometeorol. Inst. (Kiev), v. 47, 1965 p 51–58
(Contract AF 19(628)-3880)
(T-R-524; TT-66-60907; AD-630673) CFSTI: HC $1.00/MF $0.50

The relation of the accuracy of radar measurements of shower precipitation to the area surveyed and the time interval between measurements is examined. Areas of 81 to 648 sq km and time intervals of 2 to 10 min are analyzed. Author (TAB)

N66-27432# American Meteorological Society, Boston, Mass.
THUNDERSTORM ACTIVITY OVER THE EUROPEAN USSR [GROZOVAIA AKTIVNOST' NAD EVROPEISKOI TERRITORIEI SSSR]
V. A. Solov'ev Bedford, Mass, AFCRL, Jan. 1966 20 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 163, 1964 p 76–86
(Contract AF 19(628)-3880)
(T-R-548; TT-66-60906; AD-630672) CFSTI: HC $1.00/MF $0.50

Charts of thunderstorm activity as a function of the number of thunderstorm centers are plotted on a trial basis from lightning-recorder data. Information is given on the number and duration of thunderstorms and the number of days with thunderstorms by five-degree geographic squares of the European USSR on the basis of weather-station data. Author (TAB)

N66-27445# American Meteorological Society, Boston, Mass.
FLUCTUATIONS OF THE LARGE-DROPLET COUNT IN STRATIFORM CLOUDS [O FLUKTUATSIIAKH CHILSA KRUPNYKH KAPEL' V OBLAKAKH SLOISTYKH FORM]
M. I. Dekhtiar and M. V. Bulkov Bedford, Mass., AFCRL, Jan. 1966 32 p refs Transl. into ENGLISH from Tr. Ukr. Nauchn.-Issled. Gidrometeorol. Inst. (Kiev), v. 48, 1965 p 21–38
(Contract AF 19(628)-3880)
(T-R-538; TT-66-60837; AD-630555) CFSTI: HC $2.00/MF $0.50

The relative fluctuations of the number of large droplets in stratiform clouds are examined for a nonturbulent atmosphere. The principal physical parameters of a cloud (liquid-water content, thickness, and velocity of ordered air flows)

are regarded as random correlated quantities distributed according to a normal law. Formulas are obtained that relate the relative fluctuations of the number of large droplets to the relative fluctuations of the principal physical parameters of a cloud. It is shown that this can be used to explain the relatively wide fluctuations of the number of large droplets observed in experiment. Author (TAB)

N66-27634# Air Force Cambridge Research Labs., Bedford, Mass.

BALLOON ASCENT TRAJECTORY DISPERSION OVER THE UNITED STATES AT 60,000 FT AND 100,000 FT

George F. Nolan Feb. 1966 33 p refs *Its* Surv. in Geophys. No. 174

(AFCRL-66-98; AD-631502) CFSTI: HC $3.60/MF $0.50

A series of seasonal statistical charts is presented which can be used for obtaining estimates of ascent trajectory dispersion at altitudes of 60,000 ft and 100,000 ft for balloons launched from locations within the United States. The charts give isopleth mappings of mean ascent trajectory components, angle of rotation of axes of the dispersion patterns, and standard deviations of the components along the major and minor distribution axes. The chart data and outlined procedures furnish the means of constructing balloon ascent trajectory dispersion patterns, with a minimum amount of time and effort for any specified constant balloon ascent rate and for any desired degree of probability. These dispersion patterns provide useful planning information for purposes of air safety and other operational considerations. An analysis of the stability of the mean ascent trajectories shows a wave pattern distribution over the United States with a ridge of maximum stability, or minimum dispersion, centered along longitude 110 degrees and troughs of minimum stability, or maximum dispersion, located over the northeast and over the northwest. Author (TAB)

N66-27691# Aracon Geophysics Co., Concord, Mass.

METEOROLOGICAL SATELLITE TECHNIQUES FOR THE ARMY Third Quarterly Technical Report, 1 Nov. 1965-31 Jan. 1966

P. E. Sherr, C. W. C. Rogers, and J. C. Barnes Mar. 1966 15 p refs *Its* Rept.-9G21-10

(Contract DA-28-043-AMC-01273(E))

(ECOM-02173-3; AD-631509) CFSTI: HC $1.60/MF $0.50

The research reported herein, conducted during the third quarter of a contractual investigation, was aimed at providing Army field units with techniques for the use of weather satellite data. Results to date for each of several tasks are discussed. These include: (1) mesoscale analysis and interpretation studies; (2) analysis of Army requirements for applications of weather satellite data; (3) case studies of World War II, Korean or U.S. field maneuver synoptic situations, using analogs for which satellite data are available; (4) investigations of methods for determining weather affecting enemy operations; (5) procedures for field use of meteorological satellite data; and (6) operational guide preparation. The research, and draft chapters of the final report, have been completed for many Tasks. For these Tasks, only a summary statement of principal results is included here. More comprehensive discussions of these completed Tasks can be found in Reports (AD-623 532, AD-627 442), and will be included in the forthcoming final report and operational guide being prepared under this contract. Brief discussions of the yet uncompleted Tasks are provided here. Author (TAB)

N66-27704# Air Force Cambridge Research Labs., Bedford, Mass. Meteorology Lab.

COMPUTER PROCESSING OF MESOSCALE RAWINSONDE DATA FROM PROJECT STORMY SPRING

Carl W. Kreitzberg and William E. Brockman (Dayton Univ. Res. Inst.) Feb. 1966 100 p refs *Its* Spec. Rept.-41

(AFCRL-66-97; AD-631780) CFSTI: HC $3.00/MF $0.75

This report documents the data reduction procedures used for processing the mesoscale rawinsonde data obtained during Project Stormy Spring. Temperature and humidity data at each pressure contact (about each half-minute) and azimuth and elevation data at either two or ten times per minute were entered on punched cards. The 50-mb layer data for a series of soundings at one station were computed and used in another program to compute local time derivatives and single-station thermodynamic vertical velocities. Data at numerous isobaric and isentropic levels were obtained by interpolation. Data output took a variety of forms including: listings of soundings, time sections, isobaric and isentropic plane sections, mechanical plots of soundings of Skew-T log P diagrams, time traces, punched cards, and magnetic tapes. Author (TAB)

N66-27712# Alaska Univ., College. Geophysical Inst.

ICE FOG: LOW TEMPERATURE AIR POLLUTION DEFINED WITH FAIRBANKS, ALASKA AS TYPE LOCALITY

Carl S. Benson Nov. 1965 195 p refs

(Grants DA-ENG-11-190-61-G3; DA-ENG-27-021-62-G5; DA-AMC-27-021-64-G8)

(UAG-R-173; AD-631553) CFSTI: HC $5.00/MF $1.00

Stable pressure systems over interior Alaska sometimes produce prolonged, extreme (below −40° C) cold spells at the surface. The meteorological conditions responsible for two such cold spells are discussed in detail, where it is shown that the rate of radiative cooling of the air is enhanced by suspended ice crystals which are themselves a result of the initial cooling. Radiation fogs formed during the onset of cold spells are generally of short duration because the air soon becomes desiccated. These fogs consist of supercooled water droplets until the air temperature goes below the 'spontaneous freezing point' for water droplets (about −40°C); the fog then becomes an ice crystal fog, or simply 'Ice Fog.' During the cooling cycle water is gradually condensed out of the air until the droplets freeze. At this point there is a sharp, discontinuous decrease in the saturation vapor pressure of the air because it must be reckoned over ice rather than over water. The polluted air over Fairbanks allows droplets to begin freezing at the relatively high temperature of −35° C. Between −35° and −40°C the amount of water vapor condensed by freezing of supercooled water droplets is 3 to 5 times greater than the amount condensed by 1°C of cooling at these temperatures. This results in rapid and widespread formation of ice fog which persists in the Fairbanks area as long as the cold spell lasts. The persistence of Fairbanks ice fog depends on a continual source of moisture (4.1× 1,000,000 Kg H_2O per day) from human activities within the fog. Author (TAB)

N66-27713# Weather Bureau, Washington, D. C.

SOME CLIMATIC FEATURES OF THE NORTHWESTERN SLOPE OF THE GREENLAND ICE CAP (EAST OF THULE) Final Report, Sep. 15, 1964-Mar. 15, 1966

Nina A. Stepanova and P. Putnins [1965] 110 p refs Sponsored by ARMY

(AD-631415) CFSTI: HC $4.00/MF $0.75

The climatic observations at three stations along the slope and at one station at the edge of the ice cap, east from

Thule, were evaluated. The following elements were analyzed: temperature: annual and diurnal course of temperature, extreme temperatures, a periodic fluctuation of temperature (also a case of strong warming along the slope was investigated), temperature lapse rates along the NW and SW slopes of the Greenland ice cap; wind regime: frequencies of wind directions, mean wind speed, maximum wind speed; cloudiness: annual and diurnal variation of cloudiness, frequencies of clear and overcast sky, diurnal range of cloudiness, and a case of sudden extreme change of cloudiness. Author (TAB)

N66-27791# Emmanuel Coll., Boston, Mass. Oriental Science Library.

SUMMARY AND TABLE OF CONTENTS APPEARING IN THE MONOGRAPH "A STUDY OF THE MICROPHYSICAL MECHANISM OF WARM-CLOUD PRECIPITATION"

Hsiu-chi Chou Dec. 1965 4 p Transl. into ENGLISH from Chinese

(Contract AF 19(628)-5073)

(EMM-65-51(a); AD-631032) CFSTI: HC $1.00/MF $0.50

This monograph on modern meteorology contains a summary of the results of a study of the microphysical mechanism of warm-cloud precipitation in China during the past three years. Included is a critical survey of the related topics investigated in other countries. The monograph begins with a discussion of the characteristics of the stochastic growth of cloud droplets, followed by a review of the theories of cloud-droplet growth. The effect of a fluctuating humidity distribution on condensation growth, the collision and coalescence growth in a fluctuating density field, a turbulence field and due to fluctuating vertical current, and the mechanism for cloud droplet electrification together with the effect of electric charge on collision and coalescence growth are examined. On the basis of the results obtained, a more general statistical theory of warm-cloud precipitation is proposed. This theory, when compared with the past theory of gravitational collision and coalescence, permits a more objective generalization of facts. The concept of stochastic process introduced in this theory can also be extended to the study of the microphysical processes of cool-cloud precipitation. The theoretical analysis of these problems offers a new approach to the understanding and further study of the microphysical processes of cloud and fog precipitation. TAB

N66-27801# American Meteorological Society, Boston, Mass.

BALLOON-BORNE ELECTRIC METEOROGRAPH [AEROSTATNYI ELEKTRICHESKII METEOROGRAF]

A. A. Ledokhovich Bedford, Mass., AFCRL, Feb. 1966 9 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 154, 1964 p 105–108

(Contract AF 19(628)-3880)

(T-R-586; AD-630668) CFSTI: HC $1.00/MF $0.50

The design of the balloon-borne electric meteorograph described herein includes a special cable that transmits the data of the meteorological measurements directly to the ground at the instant of measurement. Author (TAB)

N66-27831# American Meteorological Society, Boston, Mass.

LOCAL FORECASTING OF FOG FORMATION [LOKAL'NYI PROGNOZ OBRAZOVANIIA TUMANOV]

M. E. Berland, V. P. Gracheva, and G. A. Fateeva Jan. 1966 22 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 127, 1962 p 57–68

(Contract AF 19(628)-3880)

(T-R-490; AD-630671) CFSTI: HC $1.00/MF $0.50

After proposing an improved method for precomputing fogs on the basis of observations from a single station, the authors derive a technique for forecasting the nocturnal variation of the specific humidity, refine the means of forecasting the nocturnal minimum temperature of the atmospheric surface boundary layer, and present the results of checking the method against observational data from a number of weather stations. Author (TAB)

N66-27863# American Meteorological Society, Boston, Mass.

APPROXIMATION OF TWO-DIMENSIONAL FIELDS BY CHEBYSHEV POLYNOMIALS [APPROKSIMATSIIA DVUMERNYKH POLEI POLINOMAMI CHEBYSHEVA]

T. M. Krupitskaia and K. E. Chernin Bedford, Mass., AFCRL, Jan. 1966 23 p refs Transl. into ENGLISH from Tr. Arkticheskogo i Antarkt. Nauchno-Issled. Inst. (Leningrad) v. 271, no. 1, 1964 p 31–44

(Contract AF 19(628)-3880)

(T-R-521; TT-66-60903; AD-630669) CFSTI: HC $1.00/MF $0.50

Based on the orthogonality of specially formulated functions, Chebyshev polynomials were used to represent two-dimensional fields in combined meteorological and hydrological problems. It is shown, however, that the analytical representation obtained does not provide a sufficiently uniform approximation of the field; the approximation errors are slight in the center of the field, but they increase with the distance from the center. Thus, in order to obtain a more uniform approximation with the Chebyshev polynomials, a sectional method of expansion of two-dimensional fields was derived. D.T.

N66-27864# American Meteorological Society, Boston, Mass.

THE PULSATION SPECTRA OF THE VERTICAL COMPONENT OF WIND VELOCITY AND THEIR RELATIONS TO THE MICROMETEOROLOGICAL CONDITIONS [SPEKTRY PUL'SATSII VERTIKAL'NOI KOMPONENTY SKOROSTI VETRA I IKH SVIAZI S MIKROMETEOROLOGICHESKIMI USLOVIIAMI]

A. S. Gurvich Bedford, Mass., AFCRL, Jan. 1966 60 p refs Transl. into ENGLISH from Tr. Inst. Fiz Atmos. (USSR), no. 4, 1962 p 101–136

(Contract AF 19(628)-3880)

(T-R-509; TT-66-60901; AD-630667) CFSTI: HC $3.00/MF $0.75

Details are given on the construction of an acoustic microsnemometer and frequency analyzer, using capacitive electroacoustic transducers with solid dielectrics and acoustic devices for measuring the wind velocity and air temperature. Diagrams of the circuitry are presented, and the components are described. A technique was developed for measuring the frequency spectra of the vertical velocity component pulsations. The processing of results using the similarity theory and the assumption of frozen turbulence permitted the derivation of the shape of the universal spectral functions. Several spectral functions are graphed and analyzed. The eddy kinetic energy distribution showed that the main portion of the energy is concentrated in the region of frequencies which correspond to scale lengths of the order of the height of observation. The values of the structural functions of a wind velocity difference were computed from the vertical profiles of wind velocity and temperature. The behavior of the universal spectral functions in the inertial subrange was considered to be in good agreement with the similarity theory. N.E.N.

N66-27875# Army Electronics Labs., Fort Monmouth, N. J. Atmospheric Sciences Lab.
WHITE SANDS MISSILE RANGE CLIMATE CALENDAR
Paul H. Taft Apr. 1966 30 p refs
(ECOM-5041; AD-631558) CFSTI: HC $2.60/MF $0.50

Mean daily maximum and minimum temperatures and extreme temperatures for the period of record (1950–1965) are tabulated in calendar form for the weather station located at Headquarters, White Sands Missile Range, New Mexico. Averages of temperature, relative humidity, precipitation, wind and cloudiness are included for each month, as well as extremes of monthly and 24-hour rainfall. Supplementary tables give monthly, seasonal and annual values of maximum winds, degree days, number of days with occurrence of thunderstorms and visibility restrictions, means and extremes of station pressure, and average 6-hourly relative humidity. Weekly means of maximum and minimum temperatures and weekly values of precipitation are also presented, in graph form, as well as a summary of weather extremes for the State of New Mexico. Author

N66-27948*# Aracon Geophysics Co., Concord, Mass.
ORBITAL AND METEOROLOGICAL FACTORS PERTINENT TO SATELLITE TRANSMISSIONS OF FACSIMILE WEATHER CHARTS Final Report
Arthur R. Hall, Romeo R. Sabatini, John E. Sissala, and Louis Novotny Dec. 1965 148 p refs *Its* Rept.-9G23-F
(Contract NAS5-9664)
(NASA-CR-75588) CFSTI: HC $4.00/MF $1.00 CSCL 04B

The Automatic Picture Transmission (APT) system, on both Nimbus-type and earth-synchronous satellites, for the transmission of weather charts (WEFAX), with particular reference to orbital and meteorological factors has been found to be feasible. This system of weather chart transmission would particularly benefit those areas that have inadequate radio or landline facsimile coverage. An earth-synchronous satellite, with 20 or 25 minutes of WEFAX transmissions every six hours, could provide useful basic weather charts for the entire area where its transmissions can be received. The transmissions of WEFAX along a sun-synchronous orbit would be divided into tropical, mid-latitude, and polar chart areas. The chart areas transmitted would be modified every 30 degrees of longitude for the tropical and mid-latitude charts, and every 60 degrees of longitude for the polar charts. In general, the most useful weather charts are a surface analysis and an upper air analysis (usually 500 mb, but often 200 mb in the tropics), and prognoses for similar levels. Weather chart selections recommended for transmission, for various single and multiple satellite configurations, are presented, and illustrated by full scale typical maps, and by maps depicting the recommended geographical areas of coverage.

Author

N66-27987# Genoa Univ. (Italy). Istituto Geofisico e Geodetico.
[METEOROLOGICAL OBSERVATORIES] Activity Report, Three Year Period, 1962–1963–1964 [RELAZIONE SULL' ATTIVITA SVOLTA NEL TRIENNIO, 1962–1963–1964]
Mario Bossolasco 1965 14 p refs In ITALIAN
CFSTI: HC $1.00/MF $0.50

Scientific research and teaching activities at the Geophysical and Geodetic Institute of the University of Genoa are reported, and work in association with certain meteorological observatories is mentioned. In the fields of aeronomy and geomagnetism, observations by the ionospheric station continue to be recorded, and various publications on research work are noted. Meteorological activities, including solar radiation and radio meteorological measurements, are listed for this period. In connection with the International Quiet Sun Year, the vertical gradiant of the electro-atmospheric field was recorded. The marine physics program on recording wave motion and sea temperature continued. The earthquake near the Ligurian Sea was studied in depth and results were published. Transl. by R.Li.

N66-28002# Aeronautical Research Council (Gt. Brit.).
LOW ALTITUDE GUST MEASUREMENTS OVER THREE ROUTES IN THE U.K.
E. W. Wells London, HMSO, 1965 33 p refs Supersedes RAE-TN-STRUCT-320, ARC-24504
(ARC-CP-676; RAE-TN-STRUCT-320; ARC-24504) CFSTI: HC $2.00/MF $0.50

A number of flights have been made at low altitude over three routes in the U.K. The routes were in Sussex, East Anglia and Wales. Measurements made with a counting accelerometer have been analyzed to investigate the effect of variation in terrain and meteorological conditions on the intensity of turbulence. A comparison has also been made between these flights and flights made at low altitude in North Africa. Author

N66-28057# Aracon Geophysics Co., Concord, Mass.
TECHNIQUES FOR IMPROVING GEOGRAPHICAL LOCATIONS OF TIROS RADIATION DATA LISTED FROM FMRT, APPENDIX A Final Report
Paul E. Sherr May 1965 27 p refs
(Contract Cwb-10812)
(Rept.-8G6-F-A)

This appendix is an amplification of previous work on errors in geographic locations of Tiros infrared radiation data listed from the Final Meteorological Radiation Tapes, and demonstrates that analyses at this scale are not only possible but revealing. The discussion suggests techniques for reducing location errors. R.N.A.

N66-28061# Barnes Engineering Co., Stamford, Conn.
REMOTE DETECTION OF CLEAR AIR TURBULENCE BY MEANS OF AIRBORNE INFRARED INSTRUMENTS
Eric M. Wormser [1965] 25 p refs

Air temperature gradients are frequently associated with clear air turbulence. Radiation measuring instruments have already been used for the remote sensing of air temperature. A suitably-designed instrument should give adequate warning of turbulence regions ahead and provide an opportunity for their avoidance. A spectral scanning infrared radiometer has been designed for this purpose and is described in this paper. Extensive ground tests have been conducted, including making atmospheric temperature analyses in horizontal and vertical directions. Mountaintop tests will follow. Detection ranges of 25 miles are anticipated.

Author

N66-28089# Emmanuel Coll., Boston, Mass. Oriental Science Library.
TRANSLATED SUMMARY AND ABSTRACTS OF ARTICLES APPEARING IN THE MONOGRAPH: "A COLLECTION OF ARTICLES ON DYNAMIC METEOROLOGY"
Chen-Chao Koo [1965] 8 p refs Transl. into ENGLISH from a rept. published by Sci. Press, Peking, 1961 106 p
(Contract AF 19(628)-5073)
(EMM-65-50(A); TT-66-61006; AD-631031) CFSTI: HC $1.10/MF $0.50

The first part of this monograph consists of three articles. The first two articles discuss certain problems in meteorology from the point of view of cybernetics. In the second article, the technique of transfer function in automatic control theory is used to analyze a linear model for long-range numerical prediction. In the third article, the instability problem of large-scale atmospheric processes is investigated using Liapounoff's theory of stability. The second part of this monograph contains four articles dealing with processes of atmospheric heating and problems involved in long-range numerical prediction.
TAB

N66-28204# Defence Research Board, Ottawa (Ontario). Directorate of Scientific Information Services.
CLIMATE AND THUNDERSTORMS
V. I. Arabadzhi Apr. 1966 9 p Transl. into ENGLISH from Priroda (Moscow), v. 2, 1966 p 65-66
(T-456-R) CFSTI: HC $1.00/MF $0.50

Variations in the activity of world thunderstorm foci, areas with an average of more than 100 days of storms per year, are shown to indicate the evolution of the climatic characteristics of the particular locality involved. It is pointed out that until recently one of the strongest foci was in the Bogor City area of Indonesia, where since 1953 there have been only four to 41 days of storms annually. Since the temperature regime in this area has remained stable over the last 60 years, the reduced level of thunderstorm activity is considered to be related to variations in evaporation. In the Carauari region of Brazil there are 18 years between 1932 and 1956 when thunderstorm activity was severe, with many years having 200 days of storms; here, the tendency has been toward a decline in thunderstorm activity too. In the Cuiaba area of Brazil no important variations in the amount of precipitation have been recorded in the last 60 years, with the mean number of thunderstorm days fluctuating around 100.
M.W.R.

N66-28207# Finnish Meteorological Office, Helsinki.
PRECIPITATION AND SNOW COVER DATA, 1964 [SADE JA LUMIHAVAINNOT, 1964]
Jul. 1965 100 p refs In FINNISH and ENGLISH *Its* Meteorol. Yearbook of Finland, vol. 64, pt. 2
CFSTI: HC $3.00/MF $0.75

Tabulated data, scale maps, and charts from rain observations recorded during 1964 and snow observations recorded during the winter 1963-1964 by Finnish meteorological stations are presented. The conditions of measurement (time divisions e.g.) are discussed. Data on the daily course of precipitation and duration of rain in Sodankyla and in Helsinki were reduced by a ratio equivalent to the Wild gauge result. The ratio was computed from the total rainfall of a summer season. Tables regarding snow cover indicate the annual course of its depth and density. These data are related to the snow depth on March 15 when the snow cover in Finland is usually at its deepest. The water equivalent was also measured.
L.S.

N66-28219# Technical Univ. of Denmark, Lyngby.
ON TURBULENCE IN OPEN CHANNEL FLOW. STATISTICAL THEORY APPLIED TO MICROPROPELLER MEASUREMENTS
Ivar G. Jonsson Copenhagen, Danish Acad. of Tech. Sci., 1965 49 p refs
(Ci-31) CFSTI: HC $2.00/MF $0.50

Longitudinal velocity fluctuations in uniform and steady open channel flow over a rough bed were studied by measuring the statistical variation of the velocity, averaged over certain time intervals, with a tiny aluminium propeller. A version of a statistical theory, used in meteorology, combined with a simple exponential form for the time correlation function, yielded values for the turbulent intensity and the macro time and length scales at different levels. These measurements were compared with a number of other measurements and indicate that the turbulent intensity and the length scale will increase with decreasing bottom roughness. A simple "eddy time" can be used as a measure for the time scale. The investigation leads to a simple way of predicting the accuracy of mean velocity measurements in turbulent flows.
Author

N66-28225# India. Meteorological Dept., New Delhi.
MAGNETIC, METEOROLOGICAL AND ATMOSPHERIC ELECTRIC OBSERVATIONS MADE AT THE GOVERNMENT OBSERVATORIES BOMBAY AND ALIBAG IN THE YEAR 1955 (1876-1877 SAKA). PART I: MAGNETIC OBSERVATIONS MADE AT ALIBAG
1965 80 p
CFSTI: HC $3.00/MF $0.75

Results of geomagnetic observations made at the Indian government observatory at Alibag during 1955 are presented. The geographic and geomagnetic latitudes of the observatory are 18° 38'17" N and 9° 28' N respectively. The geographic and geomagnetic longitudes of the observatory are 72° 52'21" E and 143°36' E respectively. Tables of data are given for declination, horizontal force, and vertical force from January to December; diurnal variation of the magnetic elements; a Fourier analysis of the diurnal and annual variations of both the horizontal and vertical force; magnetic characters; and principal magnetic disturbances. Magnetograms for January 17-18, March 22-24, May 25-27, October 24-27, and November 18-20 are depicted. Time of observation and the base line are indicated on each recording. Other tables of geomagnetic data are also given.
L.S.

N66-28238# Finnish Meteorological Office, Helsinki.
CLIMATOLOGICAL DATA, 1964
1965 100 p In FINNISH and ENGLISH *Its* Meteorol. Yearbook of Finland, Vol. 64, Pt. 1A, 1964
CFSTI: HC $3.00/MF $0.75

Meteorological data from Finalnd for 1964 are tabulated. The data include climatological observations from 7 stations and monthly and yearly summaries from 142 stations. A map and a listing of these stations along with their coordinates are given.
R.N.A.

N66-28243# Institut Royal Meteorologique de Belgique, Brussels.
THE AEROLOGICAL STATION OF THE ROYAL METEOROLOGICAL INSTITUTE OF BELGIUM [HET AERLOGISCH STATION VAN HET KONINKLIJK METEOROLOGISCH INSTITUUT VAN BELGIE]
A. G. Maenhout 1965 30 p refs In DUTCH *Its* Publ. Ser. A, No. 54
CFSTI: HC $2.00/MF $0.50

An outline of activities at the Aerological Station is given. Separate chapters briefly describe: (1) daily aerological radio soundings and equipment used; (2) procedures for aerological measurements; (3) wind measurements; (4) evaluation of data obtained; (5) ozonometry; (6) atmospheric electricity; (7) radioelectric soundings of the troposphere; (8) radar soundings

of precipitations; (9) electromagnetic wave measurements; and (10) shortwave propagation in the troposphere.
Transl. by K.W.

N66-28288# Schjeldahl (G.T.) Co., Northfield, Minn. Advanced Programs Div.
SKYHOOK FLIN FLON Final Report, Mar.-Sep. 1965
Clifton P. Merrell Apr. 1966 20 p
(Contract Nonr-4859(00))
(AD-631331) CFSTI: HC $1.60/MF $0.50

Skyhook balloon flight operations from the Flin Flon, Manitoba area are reported. The program is described, flight results are presented, and recommendations are made for further studies under this program. Author (TAB)

N66-28295# Intermountain Weather, Inc., Salt Lake City, Utah.
THE INFLUENCE OF ATMOSPHERIC CONSTITUENTS UPON LONG WAVE RADIATION IN CONJUNCTION WITH THE FORMATION OF RADIATION FOG Final Report, 1 Jun. 1964–31 Mar. 1966
Wilford Zdunkowski, Donald Henderson, and J. Vern Hales Apr. 1966 104 p refs
(Contract DA-28-043-AMC-00122(E))
(ECOM-00122-F; AD-631490) CFSTI: HC $4.00/MF $0.75

This project deals with the prediction and maintenance of radiation fog. A system of physical equations, modeling the atmospheric boundary layer, is solved by numerical means. Temperature changes in fog-free air and within fog are discussed. The significance of soil parameters and exchange coefficients is studied systematically and shortcomings of the classical theory are pointed out. Author (TAB)

N66-28321# Ballistic Research Labs., Aberdeen Proving Ground, Md. Ballistic Measurements Lab.
FEASIBILITY TEST OF A POTENTIAL METEOROLOGICAL SHELL FOR THE STANDARD 175 MM GUN
John A. Brown and Spence T. Marks Feb. 1966 19 p refs
(BRL-TN-1584; AD-631245) CFSTI: HC $1.60/MF $0.50

The acquisition of timely meteorological data has a great bearing on the accuracy of placement of artillery rounds. This report describes the results of a program which was conducted by the Ballistic Research Laboratories (BRL) at the NASA Wallops Island facility to determine the feasibility of employing the standard 175 mm gun and a modified shell to obtain meteorological data quickly. Author (TAB)

N66-28385* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PERCENTAGE LEVELS OF WIND SPEED DIFFERENCES COMPUTED BY USING RAWINSONDE WIND PROFILE DATA FROM CAPE KENNEDY, FLORIDA
Dennis W. Camp and Michael Susko 12 May 1966 320 p refs
(NASA-TM-X-53481) CFSTI: HC $7.00/MF $1.75 CSCL 04B

Presentad are percentage levels of wind speed differences calculated from AN/GMD-1 upper atmospheric wind profile data observed at Cape Kennedy, Florida. Eight years of rawinsonde wind profile data (5844 profiles) were used: January 1, 1956 through December 31, 1963. The results are based on each kilometer of data using wind velocity measurements obtained for the 1.0 through 25.0 km altitude interval. The results presented may be used to (1) aid in predicting statistical limits of upper level winds, and (2) provide an understanding of the statistical results of wind speed change as a function of time. This type of information is important for space vehicle launch operations. Author

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N66-28668# Joint Publications Research Service, Washington, D. C.
[TRANSISTORIZED NAVIGATION MARKERS CONTROLLED BY SUNLIGHT]
Yueh-lin Wang *In its* Transl. on Communist China's Sci. and Technol. 13 May 1966 p 28–29 Transl. into ENGLISH from Hsin-min Wan-pao (Shanghai), 17 Mar. 1965 p 4 (See N66-26956 15-34) CFSTI: $3.00

A transistorized, sunlight actuated, valve controlled device was developed for use in navigation markers to control the light. The device automatically switches the light on during periods of darkness and turns it off during periods of sunlight. The use of this device resulted in a forty percent power saving over conventional markers in which the light remains on all the time. D.T.

N66-28669# Joint Publications Research Service, Washington, D. C.
SOLUTION POLYMERIZATION OF CETYL METHACRYLATE
Chin-k'ang Lu, Tseng-pei Ko, Yu-lin T'ien, and Ming-chun Yin *In its* Transl. on Communist China's Sci. and Technol. 13 May 1966 p 42–53 refs Transl. into ENGLISH from Kao-fen-tzu T'ung-hsun, v. 7, no. 8 11 Nov. 1965 p 396–402 (See N66-26956 15-34) CFSTI: $3.00

Cetyl methacrylate was polymerized in organic solvents in a study to determine the factors affecting the average molecular weight of the polymer during polymerization and to improve control of the polymer's properties. It was found that the average molecular weight is primarily controlled by the chain transfer constant of the solvent. But when polymers with similar average molecular weights were formed, the average molecular weight of the high conversion rate polymer was affected by viscosity effects, dependent on the molecular shapes of the particular polymer and solvent used. D.T.

N66-27697# Wisconsin Univ., Madison. Geophysical and Polar Research Center.
AN EXPERIMENT IN ARCTIC VLF NAVIGATION Final Research Report
Karl R. Redell Nov. 1965 28 p refs
(RR-65-2; AD-630786) CFSTI: HC $2.00/MF $0.50

The passage of ice island ARLIS II into the East Greenland Sea early in 1965 and the resulting higher drift rate made necessary a more continuous type of navigation than was possible with celestial navigation. An experimental VLF system was available which could theoretically provide navigational accuracies of ±2 miles. Three VLF stations (GBR, NSS, and NPG) were received on the island. The VLF phase tracking data was in error, however, due to defective preset counters in the frequency synthesizers. Operational problems and potentials of the system in Arctic use are discussed. Author (TAB)

N66-27848# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
SATELLITE DOPPLER NAVIGATION FOR SMALL CRAFT

W. H. Guier Aug. 1965 68 p refs
(Contract NOw-62-0604-c)
(TG-719; AD-631024) CFSTI: HC $3.00/MF $0.75

The paper presents a method for obtaining a navigation fix that is suitable for small craft which uses measurements of the satellite radio Doppler shift and published tables. The method utilizes integral doppler data taken in the same manner as the AN/SRN-9 equipment but changes the times at which the doppler count triggers are transmitted from the satellite. The solution tables to determine the navigator's position relative to the satellite are new. The form of the solution tables are factored such that accurate time and frequency standards on board the navigating craft are not needed. The accuracy of the navigation fix is essentially the same as the AN/SRM-9 equipment if the navigator is willing to hand compute several fine corrections. The navigation fix with no corrections should be accurate to about one or two nautical miles.
Author (TAB)

N66-27869# Navy Electronics Lab., San Diego, Calif.
OMEGA IN THE ATLANTIC (1963–1965): IN-PORT MEASUREMENTS FROM HMS VIDAL AND HR. MS. SNELLIUS ON OCEANOGRAPHIC SURVEY NAVADO Research and Development Report, Oct. 1963–Dec. 1965
E. R. Swanson and W. E. Davis 10 Jan. 1966 30 p refs
(NEL-1350; AD-631008) CFSTI: HC $2.60/MF $0.50

Measurements were made of 10.2-kc/s phase difference in 24 ports of call in the Atlantic area. The measurements are generally well explained by present propagation models which indicate that an implemented Omego system will have an accuracy of about 0.9 n. mi. (c.e.p.) over the 24-hour day.
Author (TAB)

N66-27985# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.
NAVIGATION SYSTEMS CONSIDERATIONS FOR INTERPLANETARY SPACE MISSIONS
A. Grumet and P. Savet Apr. 1966 18 p
(RM-318)

An interplanetary navigation system is briefly described that uses earth-based transmitters to supply the high accuracy portion of spacecraft position determination in both geocentric and heliocentric coordinates. The system outlined supplements the spacecraft's independent moderate accuracy on-board navigation system without the power and weight penalty of a high accuracy system. The ground-based, high accuracy portion of the system is completely automatic and many spacecraft can use the system simultaneously. Direction may be determined to better than one arc second. Distance may be determined by an on-board stable time reference (with subdivided phase-locked coarse timing) that will provide phase referencing in the event of power interruption at either the spacecraft or on earth. The advantages of intermittent, closed-loop attitude control are discussed.
Author

N66-28084# Federal Aviation Agency, Atlantic City, N. J. Test and Evaluation Div.
OPERATIONAL EVALUATION OF AIR ROUTE SURVEILLANCE RADAR (ARSR) WEATHER SURVEILLANCE SYSTEM, TYPE FAA-ER-240-003
Anthony D. Bradley Apr. 1966 69 p
(RD-66-10)

An operational evaluation was conducted at the Washington Air Route Traffic Control Center (ARTCC) to determine the operational utility of weather contours generated by the air route surveillance radar (ARSR) weather surveillance system. The system was designed to present iso-amplitude contours of the weather. A solid-line contour of all the weather information detected by the system was presented to three ARTCC displays. It was concluded that the weather contours are operationally unsuitable for use in the low altitude control area due to the contouring of ground clutter and anomalous propagation (AP). However, the weather contours with contoured ground clutter and AP can be tolerated and utilized operationally by the high altitude radar controller. It was recommended that the ARSR weather surveillance system not be used and a suitable weather contouring system be developed. It was further recommended that an interim low cost weather contouring device be developed for use by the high altitude radar controller.
Author

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N66-27091# Oak Ridge National Lab., Tenn.
[REACTOR DEVELOPMENT, PHYSICAL RESEARCH, BIOLOGY AND MEDICINE, ISOTOPE DEVELOPMENT, AND TRAINING, EDUCATION AND INFORMATION] Third Annual Report, 1964
[1964] 215 p refs
(Contract W-7405-ENG-26)
(ORNL-3900) CFSTI: HC $6.00/MF $1.25

Progress in reactor development, physical research, biology and medicine, and isotope development at the Oak Ridge National Laboratory is reported. These include studies in such areas as the gas-cooled reactor program, applied and basic reactor physics, reactor theory, reactor fuels and materials, nondestructive test development, radiation stability of structural metals, power reactor fuel processing, thorium utilization, molten-salt reactor program, space reactor studies, nuclear desalting program, nuclear safety, radioactive waste disposal, mathematics and chemistry, radiation genetics, molecular and cellular level studies, and terrestrial and freshwater ecology.
C.T.C.

N66-27096# Atomics International, Canoga Park, Calif.
PIQUA NUCLEAR POWER FACILITY REACTOR OPERATIONS ANALYSIS PROGRAM Semiannual Progress Report No. 6, 1 Jan.–30 Jun. 1965
H. Cataldo, W. S. De Bear, T. Y. Fukushima, O. G. Jenkins, D. E. Lewet al 15 Dec. 1965 137 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-11628) CFSTI: HC $4.00/MF $1.00

Progress is reported in the Piqua (Ohio) nuclear power facility reactor operations analysis program. Areas discussed include a review of operations, reactivity history, core changes, relative power studies, instrumented fuel element temperatures, main heat transfer systems analysis, in-vessel and degasifier filter performance, coolant chemistry and analysis, postirradiation examination of fuel elements, and individual examination procedures and results.
C.T.C.

N66-27099# Atomic Energy Commission, Washington, D. C. Div. of Research.
PULSED HIGH INTENSITY FISSION NEUTRON SOURCES. PROCEEDINGS OF A SYMPOSIUM ON USES OF HIGH INTENSITY PULSES OF NEUTRONS AND THE METHODS FOR PRODUCING THEM
G. A. Kolstad and I. F. Zartman Feb. 1965 185 p refs Symp. held Feb. 1965
(CONF-650217) CFSTI: HC $1.75/MF $1.00

Proceedings of a symposium on uses of high intensity pulses of neutrons and the methods for producing them are presented. Areas covered include fast reactors, sub-critical neutron amplifier systems, fast reactors repetitively pulsed by mechanical means, repetitively pulsed accelerator boosters, inelastic scattering with pulsed neutron sources, some aspects of neutron diffraction and elastic scattering, radiation damage, use of polarized beams, and neutron cross section measurements using pulsed sources. C.T.C.

N66-27100# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
DETERMINATION OF MAXIMUM NUCLEAR TUBE POWERS BASED ON BOILING BURNOUT
G. M. Hesson Dec. 1965 21 p refs
(Contract AT(45-1)-1830)
(BNWL-176) CFSTI: HC $1.00/MF $0.50

A method is described to define the maximum tube power of a pressure tube reactor as limited by boiling burnout. The method divides all those factors involved in a boiling burnout analysis into two groups and a factor called a consequence factor. The two groups consist of: those whose value and effect can be defined with reasonable accuracy, and those whose value or effect is uncertain but which must be estimated. The consequence factor is determined from an assessment of the consequences of boiling burnout. These factors and the relation they impose between the boiling burnout heat flux and the average heat flux derived from the measured tube power are presented. NSA

N66-27103# Sandia Corp., Albuquerque, N. Mex.
ROVER/NERVA DESTRUCT SYSTEM TEST RESULTS, ABERDEEN PROVING GROUND—3 Final Report
R. E. Berry and J. P. Martin Dec. 1965 252 p
(Contract AT(29-1)-789)
(SC-RR-65-620) CFSTI: HC $6.00/MF $1.25

A full-scale destruct test of the ROVER/NERVA space propulsion engine was made. In the test, a full-scale mock-up of the ROVER/NERVA was destroyed by four statically emplaced, 105 mm special explosive charges. The information and data obtained from the test were to establish the spatial distribution of particles, the size distribution as a function of the mass, and velocity. The instrumentation for the full-scale destruct test successfully obtained the desired data. Particle sizes up to 20 microns were obtained by air sampling, but these small particles did not contain uranium. Pressure measurements obtained were 23 psi at 20 feet, 8 psi at 30 feet, and 4.2 psi at 40 feet. Graphite debris velocity recorded was 570 fps over 20 feet; however, the debris velocity dropped to 420 fps over 70 feet. Part of the debris from this test was distributed radially, and the remainder was dispersed in five concentrated jets. The metallic components (skin, reflectors, and control drums) were deployed in a symmetrical radial pattern, and each numbered component moved on a radial line from its location prior to the destruct test. The core and graphite reflector did not follow the radial pattern but flowed within the core cavity and were deployed in four horizontal jets, 90° apart, and in a vertical jet. Results are included. Author (NSA)

N66-27104# Los Alamos Scientific Lab., N. Mex.
ADVANCED REACTOR TECHNOLOGY (ART) Quarterly Status Report, Period Ending 31 Oct. 1965
30 Nov. 1965 75 p refs
(Contract W-7405-ENG-36)
(LA-3431-MS) CFSTI: HC $3.00/MF $0.75

Further development in the components of the proposed Fast Reactor Core Test Facility is reported. Results from fuel capsule testing in the Omega West Reactor are presented. The containers were carbonized and noncarbonized Ta and Te-W alloys. The fuel was Ce-Co-Pu alloys. Research on plutonium fuels is discussed. Various properties of the fuels are given. Further developments in the Turret Reactor are reported, and also research on a plasma thermocouple is discussed. NSA

N66-27108# Oak Ridge National Lab., Tenn.
GAS-COOLED REACTOR PROGRAM Semiannual Progress Report, Period Ending Sep. 30, 1965
Feb. 1966 316 p refs
(Contract W-7405-ENG-26)
(ORNL-3885) CFSTI: HC $7.00/MF $1.50

Separate abstracts were prepared for the nine included sections. Methods for coating pyrolytic carbon to UC_2 and ThC_2 fuel particles are discussed in some detail. The results of a phase study of the pseudobinary system UC_2–ThC_2 are presented. Tabulations of thermodynamic data for the UC and UC_2 systems are given. Techniques for converting sol-gel oxide particles to carbides are discussed. Heat and irradiation tests were performed on the pyrolytic carbon coated fuel particle. Results from these tests are presented. Fuel assemblies employing carbon coated fuels were tested. Discussion are presented on instantaneous fission gas release experiments, fission product release from high-burnup coated UC_2, $(Th,U)C_2$, and UO_2 particles by post-irradiation annealing, sorption of fission product vapors on structural metals, compatibility of pyrolytic carbon-coated fuel particles with water vapor, and recoil of fission products in pyrolytic carbon. The dimensional stability and thermal conductivity of AGOT graphite were investigated. Discussions and results are presented on the creep of graphite under irradiation, deposition of carbon on ATJ graphite, BeO-graphite compatibility, and failure characteristics of EGCR-Type AGOT graphite. Pyrolytic carbon-coated ThC_2–UC_2 fuels were irradiation tested for the AVR reactor. Results from three different tests are presented. In addition, the fission gas release from AVR production particles and the performance of the fueled graphite spheres are discussed. The effect on high temperature gas-cooled reactor conversion ratios and fuel-cycle cost of using a fuel that rapidly releases the fission products instead of retaining them was investigated. Diagrams show the net conversion ratios at a power density of 7 w/cm^3 and doubling times for the total fission inventory. The fuel-cycle costs at a power density of 7 w/cm^3 are given. In addition, a brief summary of results from mechanical experiments on nozzle-to-spherical shell attachments is presented. Results of graphite-air oxidation studies in the EGCR are presented. Discussions are presented on the core cooling requirements and nitrogen purge effectiveness for extreme coolant piping ruptures and the effect of increased oxidation rate, higher initial temperatures, and increased oxidation

depth on required air coolant flow. The development and testing of the following components for the EGCR are discussed: compressor shaft seals, control rod drive test, charge-machine cylinder-seal development, and special fuel assemblies for flux mapping. In addition, brief summaries of experimental studies of steam-graphite reactions and failure of the 42-in. bellows between the EGCR containment shell and the experimenters shell are presented. Results of irradiation testing of prototype fuels for the EGCR are presented. In addition, a brief summary of the pressure vessel surveillance program for the EGCR is presented. Two types of fuel elements were investigated for fast gas-cooled reactors. The design and planned operating conditions for both elements are summarized. NSA

N66-27108# Martin Co., Baltimore, Md.
INVESTIGATION OF GAS PRESSURE BUILDUP IN THERMOELECTRIC SNAP GENERATORS, FEBRUARY–DECEMBER 1963
W. A. Mc Donald and J. Mc Grew Jan. 1964 47 p
(Contract AT(30-1)-3143)
(MND-3143-1)

The program for investigating gas pressure buildup in thermoelectric genrators was initiated in February 1963 and continued through December 1963. The program objectives were to determine the source(s) of internal gas pressure increase in SNAP thermoelectric generators, establish methods of alleviating or eliminating the condition, and conduct a proof-of-principle test on an electrically heated 60-watt thermoelectric SNAP generator to determine the effectiveness of the procedures developed to control or eliminate the condition. The gas pressure increase in the generators that were initially filled with dry inert gas results from decomposition of the phenol-formaldehyde resin that is used as a binder in the Min-K 1301 thermal insulation and desoprtion of atmospheric gases and water vapor that absorb on the surface of the insulation. The degree of gas release in both cases was determined to be temperature and pressure dependent. The recommended procedure to control gas pressure buildup for all future generators is: (1) precondition the Min-K by burning off the phenolic resin binder; (2) vacuum outgas the insulation at a temperature above its maximum operating temperature; and (3) install a gas getter (zirconium) to absorb any gases that may be released during subsequent generator operation. The complete recommended procedure to control this pressure buildup could not be employed in the 60-watt thermoelectric SNAP generator test since the generator had been previously constructed and assembled using Min-K that had not been preconditioned by outgassing. Therefore, a modified outgassing procedure was established for the generator when the test was initiated. The procedure, in essence, specified that the generator be maintained on continuous evacuation while the thermoelement hot junction temperature was slowly increased to ~525° F, and that the generator be subjected to frequent rapid evacuations and gas changes as the temperature was increased to 960° F. (Lead telluride thermoelements begin to sublime in a vacuum at elevated temperatures in the 950° to 1000° F range.) An amount of 2,143 grams of zirconium sponge were inserted in the hottest region of the generator to react with getterable gases that remained after the outgassing and evacuation procedure. The 60-watt electrically heated SNAP generator was then maintained on a stability test for two months. The generator internal gas fill pressure remained essentially constant throughout the period, demonstrating that the recommended control procedure will alleviate the internal gas pressure buildup condition. Author (NSA)

N66-27109# California Univ., Livermore. Lawrence Radiation Lab.
RHOBURN: A NUCLEAR REACTOR CODE FOR CALCULATING BURNUP AND OPERATIONAL PARAMETERS FOR THE LPTR
Gordon V. Pefley, Jr. 20 Aug. 1963 44 p refs
(Contract W-7405-ENG-48)
(UCRL-7477) CFSTI: $1.00

RHOBURN is a nuclear reactor code that determines various parameters for the Livermore Pool Type Reactor using a matrix of 840 cells, stored in two-dimensional form. The code calculates the burnup of U^{235} on the basis of the megawatt days run during a fuel cycle and as a function of the neutron flux and fuel inventory in each of the 840 homogeneous cells in the reactor core. The thermal utilization and various other parameters for each core, and values for calculating the reactivity change between different cores can also be obtained. RHOBURN is written in Fortran for the IBM 7094, to be run under monitor control. Author (NSA)

N66-27111# Pratt and Whitney Aircraft, Middletown, Conn.
FISSION GAS MIGRATION STUDIES IN URANIUM CARBIDE
M. A. De Crescente and E. G. Selleck Oct. 1965 25 p refs
(Contract AT(30-1)-2789)
(PWAC-476) CFSTI: HC $1.00/MF $0.50

A technique is described for studying migration of inert gases in nuclear fuels using ion bombardment and replication electron microscopy. Helium atoms were agglomerated into 100–5000 bubbles which moved up an indicating temperature gradient. The velocity, which was found to be inversely proportional to bubble size, indicated a surface diffusion controlled mechanism. Author (NSA)

N66-27116# Atomics International, Canoga Park, Calif.
THE PREDICTED FISSION PRODUCT DECAY OF SNAPSHOT I
W. B. Sayer and R. S. Hart 15 Jan. 1966 24 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-11642) CFSTI: HC $1.00/MF $0.50

SNAPSHOT-I was the first flight test of a direct power conversion system utilizing a nuclear reactor as the heat source. The calculated fission product inventory formed during the orbital operation of the SNAP 10A reactor and the predicted decay of this activity and the associated gamma radiation levels are included. A brief system description and summary of the operational phase is included.
Author (NSA)

N66-27117# Argonne National Lab., Ill.
RIFF RAFF: A PROGRAM FOR COMPUTATION OF RESONANCE INTEGRALS IN A TWO-REGION CELL
P. H. Kier Aug. 1965 75 p refs
(Contract W-31-109-ENG-38)
(ANL-7033) CFSTI: HC $3.00/MF $0.75

A method of computing resonance absorption by a rod in a two-region cylindricalized cell that is not based on the assumption of an asymptotic neutron source distribution is developed and used to write a FORTRAN program RIFF RAFF (RP 359X), for the CDC-3600. An energy range of interest is divided into extremely narrow intervals of equal lethargy width. For each interval, the source distribution in each region is taken to be a three-term polynomial. By using this form for the source and the assumption that neutrons enter the rod isotropically, the reaction rates and the flux distribution for the interval are obtained. The reaction rates are accumulated

over specified energy intervals to obtain resonance integrals; the flux distribution is used to obtain the source distribution for intervals at lower energies. RIFF RAFF allows for ten materials in each region. There can be four resonance absorbers in the rod, each having 60 resonances. The nonresonance materials can have 1/v absorption cross sections, with the restriction that for the moderator, the macroscopic absorption cross section must be small compared to the scattering cross section. The running time for a problem with 20 resonances and 4000 fine groups is about 2 min. Author (NSA)

N66-27118# Los Alamos Scientific Lab., N. Mex.
LASL CONTROLLED THERMONUCLEAR RESEARCH PROGRAM Semiannual Status Report, Period Ending Oct. 31, 1965
7 Dec. 1965 99 p refs
(Contract W-7405-ENG-36)
(LA-3434-MS) CFSTI: HC $3.00/MF $0.75

Separate papers and results are presented on the caulked stuffed cusp minimum-B machine, plasma focus experiment, Scylla IV power-crowbarred measurements, Scylla IV operation, Scylla IV curved sector experiments, possible single-turn mirror inserts for Scylla experiments, analog solution of multipole stabilizing conductors, the small θ-pinch machine Scyllacita, Scylla I laser experiments, and magnetic mirror machine equipment development and testing. In addition, brief summaries of work are presented on Scylla plans, Fabry-Perot monochromator for scattering experiments, giant-pulse ruby laser for scattering experiments, hydromagnetic plasma gun program, transverse injection, dI/B stable closed systems, computation of electric and magnetic fields, and thermonuclear reactor blankets. NSA

N66-27119# Los Alamos Scientific Lab., N. Mex.
THE MOLTEN PLUTONIUM BURNUP EXPERIMENT
W. H. Hannum and L. D. Kirkbride 6 Jan. 1966 83 p refs
(Contract W-7405-ENG-36)
(LA-3384-MS) CFSTI: HC $3.00/MF $0.75

A reference core was selected for a Molten Plutonium Burnup Experiment. In this experiment, the fuel, a Pu–Co–Ce alloy, will be contained in sealed Ta–W alloy capsules. The principal purpose of the experiment is to obtain information on the characteristics of molten-Pu fuel during and after high burnup at high rates of fissioning. Present uncertainties prevent a detailed analysis or optimization of performance characteristics. Nevertheless, systems based on the use of this fuel alloy can reasonably be expected to have a very favorable fuel lifetime, short doubling time, and favorable safety characteristics. This experiment will be operated in the Los Alamos Fast Reactor Core Test Facility. Author (NSA)

N66-27120# Union Carbide Nuclear Co., Oak Ridge, Tenn.
THERMAL DIFFUSION COLUMN SHAPE FACTORS. PART I: SHAPE FACTORS BASED ON AN INVERSE POWER REPULSION MODEL
E. Greene, R. L. Hoglund, and E. Von Halle 7 Feb. 1966 180 p refs
(Contract W-7405-ENG-26)
(I-1469) CFSTI: HC $4.00/MF $1.00

The separation of a binary gaseous mixture which can be obtained in thermal diffusion columns can be calculated from the transport equation $\tau = Hx(1-x) - (K_e + K_d)\, dx/dz$. Two tables of shape factors are presented from which the transport coefficients H, K_e, and K_d can be calculated. Both sets of shape factors are based on an inverse-power repulsion model for the intermolecular forces. NSA

N66-27129# Brookhaven National Lab., Upton, N. Y.
PROCESS RADIATION DEVELOPMENT PROGRAM SUMMARIES. FIFTH ANNUAL CONTRACTORS MEETING OCTOBER 7–8 1965
Dec. 1965 104 p Conf. held at Upton, N. Y. 7–8 Oct. 1965
(Contract AT(30-2)-GEN-16)
(BNL-949(C-47); CONF-651064) CFSTI: HC $4.00/MF $0.75

Twenty-eight articles are included on radiation processed wood–plastic materials; radiation chemistry and radiation synthesis of fluorocarbons, polymers, organo-metallic compounds, and organic compounds; artifical kidney membranes; radiation engineering; semiconductor device fabrication by neutron transmutation techniques; radiation chemical reactors; HIRDL operations; devices for recording activity of ^{60}Co gamma sources; theory and design of gamma monochromator; radiation effects on optical maser materials; and industrial application of radiation to colloid systems. NSA

N66-27131# Kellogg (M.W.) Co., Jersey City, N. J.
PRIMARY PIPING FLEXIBILITY ANALYSIS FOR LIQUID-METAL-COOLED FAST BREEDER REACTORS
J. T. McKeon Washington, AEC, 20 Aug. 1965 56 p refs
(Contract AT(11-1)-1454)
(RD-65-1084; COO-1454-1) CFSTI: HC $3.00/MF $0.50

Design standards and technological problems involved in the flexibility analysis of primary coolant piping systems for a 1000-Mwe liquid-metal-cooled fast breeder reactor are detailed. The effects of the nuclear environment on the design requirements are studied. Theoretical and phenomenological analyses of the stresses in this type of piping are carried out. NSA

N66-27132# Argonne National Lab., Ill.
REACTOR DEVELOPMENT PROGRAM. Progress Report, Jan. 1966
24 Feb. 1966 106 p refs
(Contract W-31-109-ENG-38)
(ANL-7152) CFSTI: HC $4.00/MF $0.75

Progress is reported in liquid-metal-cooled reactors, general reactor technology, advanced systems research and development, and nuclear safety. These major areas include studies with the experimental breeder reactor-II; fast reactor physics, fuel development, and reprocessing development; sodium technology; theoretical reactor physics; high temperature materials studies; engineering development; chemical separations; the plutonium recycle program; and reactor kinetics. C.T.C.

N66-27134# Atomics International, Canoga Park, Calif.
SNAP REACTOR MATERIALS DEVELOPMENT. ULTRA-HIGH-VACUUM FRICTION STUDIES
L. G. Kellogg 9 Jun. 1964 74 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-9644) CFSTI: HC $3.00/MF $0.75

Experimental studies were conducted to determine what materials can be used in SNAP design to provide bearing compatibility. Screening tests were conducted on sixty-seven material pairs in sliding couple at ultrahigh vacuum. The friction couples are categorized into seven groups: metal vs metal, metal vs metal with dry lubricants, metal vs carbon, ceramic vs ceramic, ceramic vs ceramic with dry lubricants, metal vs ceramic, and ceramic vs carbon. Special tests were conducted using contaminant films with all groups. The theory is discussed together with practical applications. Data are presented to illustrate the effects of vacuum on sliding friction and the effects of vacuum on

surface film formation. Results indicate that carbon–graphites and sodium–silicate bonded dry-film lubricants provide relatively low friction in vacus at 100°F when coupled with Al_2O_3 (flame sprayed) surfaces. Data are when coupled with Al_2O_3 (flame sprayed) surfaces. Data are presented to show how both the carbon–graphites and dry films may be used together to provide a low friction couple through the temperature range of 70° to 800°F while operating in high vacuum. Results also indicate that sintered carbon materials provide relatively high friction in vacus at 1000°F when coupled with metallic surfaces. Several possible brake materials are discussed. Data of friction coefficient vs temperature and friction coefficient vs 1000-in. travel are presented for possible brake material couples. The test facility and the test method by which these studies were conducted is also included to provide insight into the technique employed and the results of the data. Author (NSA)

N66-27136# Los Alamos Scientific Lab., N. Mex.
RADIATION MEASUREMENTS OF THE EFFLUENT FROM THE KIWI B4D-202 AND B4E-301 REACTORS
R. W. Henderson and R. V. Fultyn 3 Feb. 1966 88 p ref
(Contract W-7405-ENG-36)
(LA-3397) CFSTI: HC $3.00/MF $0.75

The results are presented of documentation studies on the effluent from the Kiwi B4D-202 and Kiwi B4E-301 reactors during full power tests. A description of procedures and equipment is also given. An analysis of the environmental effects due to the passage and deposition of released material is given as well as deposition velocities measured at various locations. Author (NSA)

N66-27137# Los Alamos Scientific Lab., N. Mex.
COOLDOWN OF CRYOGENIC TRANSFER LINES
D. H. Liebenberg 28 Jan. 1966 22 p refs
(Contract W-7405-ENG-36)
(LA-3426) CFSTI: HC $1.00/MF $0.50

During the design and planning of the liquid hydrogen transfer lines at Test Cells "A" and "C" at the Nuclear Rocket Development Station in Nevada, LASL instituted a program to study the cooldown of these lines. Included are the several computational techniques developed to predict the cooldown process and the comparison of the computations with measurements made using the completed Test Cell "C" facility. Author (NSA)

N66-27195# Martin Co., Baltimore, Md. Nuclear Div.
STRONTIUM 90-FUELED THERMOELECTRIC GENERATOR POWER SOURCE FOR FIVE-WATT U.S. COAST GUARD LIGHT BUOY, JUN. 1962–MAR. 1964
W. Kenneth Nichols, Jr. and William A. Mc Donald Apr. 1964 22 p refs Addend. I To MND-P-2720
(Contract AT(30-1)-3043)
(MND-3043-1; MND-P-2720) CSCL 18L

A brief survey is given of the history of the development of radioisotope, reactor, and solar-cell space power supplies. Power supplies using heat directly—the ROVER rocket propulsion reactor, the PLUTO nuclear ramjet, and the POODLE rocket thruster using ^{210}Po—are described. The power systems using heat to generate electricity are discussed. Development of the reactors SNAP-2, SNAP-8, SNAP-10A, and SNAP-50 is surveyed. Requirements of isotope generators and the characteristics of ^{238}Pu, ^{90}Sr, ^{137}Cs, ^{244}Cm, and ^{210}Po for SNAP applications are discussed. The isotope generators SNAP-3, SNAP-9A, SNAP-11, SNAP-17, and SNAP-19 are described. NSA

N66-27247# Sandia Corp., Albuquerque, N. Mex.
MIE SCATTERING FUNCTIONS (MSF) COMPUTER PROGRAM DESCRIPTION
D. F. Warnke Feb. 1966 55 p refs
(Contract AT(29-1)-789)
(SC-RR-65-396) CFSTI: HC $3.00/MF $0.50

The results of the Mie Scattering theory were programmed on Sandia's CDC-3600 computer. Data inputs are the particle size parameter, complex index of refraction, scattering angle, and wavelength. Data outputs are the scattering and extinction coefficients, intensity functions, radar cross section, angular scattering cross section, and the 180-degree total scattering cross section for a given mass of monodispersed aerosol. Author (NSA)

N66-27254# Atomics International, Canoga Park, Calif.
MODULAR STEAM GENERATOR FABRICATION
L. T. Bogaert 8 Feb. 1966 47 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-11739) CFSTI: HC $2.00/MF $0.50

The fabrication is described and recommended changes in the design and fabrication procedures of future modular steam generators are presented. NSA

N66-27258# Los Alamos Scientific Lab., N. Mex.
COATED PARTICLE FUEL ELEMENTS FOR UHTREX
J. M. Taub and R. J. Bard 1 Mar. 1966 49 p refs
(Contract W-7405-ENG-36)
(LA-3378) CFSTI: HC $2.00/MF $0.50

Fuel elements for the start-up and early operation of UHTREX contain coated UC_2 particles in a graphite matrix. The fuel particles have triplex (three-layer) pyrocarbon coatings. The fuel element shock, 1 in. OD×0.5 in. ID, is fabricated by extruding a mixture of fuel particles, graphite flour, carbon black (Thermax), and resin binder (Varcum). The extruded stock is successively cured in air to 250°C, baked in vacuum to 800°C, heated in helium to 1700°C, and cut into 5.5-in.-long fuel elements. The fuel elements are then leached with 20% HCl in helium at 1600°C to remove uranium exposed by the slight amount of damage to fuel particles that occurs during the mixing and extrusion steps and by the cutting operation. The coated fuel particles, other fuel element ingredients, fabrication equipment and procedures, and properties of the finished fuel elements are described.
Author (NSA)

N66-27261# Argonne National Lab., Ill.
FABRICATION AND EVALUATION OF THORIA-URANIA FUEL MATERIAL Final Report
E. D. Lynch and J. H. Handwerk Nov. 1965 29 p refs
(Contract W-31-109-ENG-38)
(ANL-6893) CFSTI: HC $2.00/MF $0.50

Various fabrication techniques for ThO_2–UO_2 compositions such as dry-pressing, hot-pressing, and slip-casting were studied. A procedure was established for large-scale fabrication of a ThO_2–U_3O_8 composition to be used in a fuel loading. The effects of variables in fabrication and materials on the sintering behavior of ThO_2–U_3O_8 compositions were evaluated. Various samples were prepared for the evaluation of the behavior of ThO_2–UO_2 compositions under irradiation. In addition to the irradiation specimens for material evaluation, samples differing in porosity were prepared for a study

of the effect of voids on irradiation behavior, and other samples were prepared for use in determining the effects of dispersed metal fibers on the irradiation behavior of ThO_2–UO_2 fuels. Author (NSA)

N66-27263# Los Alamos Scientific Lab., N. Mex.
DPC: A TWO-DIMENSIONAL DATA PREPARATION CODE
W. H. Hannum and B. M. Carmichael 3 Feb. 1966 64 p refs
(Contract W-7405-ENG-36)
(LA-3427-MS) CFSTI: HC $3.00/MF $0.75

The DPC code prepares input in R-Z geometry for two-dimensional neutronic codes. The input to the code is a free-format reactor description, based on data in a form available from engineering drawings. A general description of regions, in terms of multiple subregions, allows for explicit consideration of detailed structural forms. During the transformation of data, general thermal expansions are included. Also, considerable data checking and evaluation are performed. Combined with the flexible narrative input, these features make the code useful in the preparation of error-free input for complex problems. Author (NSA)

N66-27328# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
FABRICATION OF ALUMINUM-BASE IRRADIATION TEST PLATES
M. M. Martin, W. J. Werner, and C. F. Leitten, Jr. Feb. 1966 44 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1377) CFSTI: HC $2.00/MF $0.50

The fabrication of the miniature aluminum-clad plates with cores of either U_3O_8 or Nb-coated UO_2–ZrO_2 dispersed in a matrix of X8001 aluminum is described, and the results of pre-irradiation examinations of the plates are presented. NSA

N66-27349# Atomic Energy Commission Research Establishment, Riso (Denmark). Chemistry Dept.
AN EXPERIMENTAL STUDY OF THE TANGENTIAL VELOCITY PROFILE IN THE RANQUE-HILSCH VORTEX TUBE
C. U. Linderstroem-Lang Sep. 1965 17 p refs
(RISO-116)

The tangential velocity profile in Ranque-Hilsch vortex tubes was calculated using the results of pressure determinations in such tubes. NSA

N66-27351# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
MACHINE-ASSEMBLED REVIEWS ON COATED NUCLEAR FUEL PARTICLES
R. L. Pilloton Dec. 1965 80 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1335) CFSTI: HC $3.00/MF $0.75

A computer-produced selection of approximately 425 reviews of recent reports, articles, and patents on coated nuclear fuel particles is presented. The 50- to 150-word summaries were prepared by the Nuclear Fuel Technology Information Center and extracted from a general magnetic tape file by a computer program based on reference codes and keywords. Specific information on the preparation, evaluation, applications, and economics of coated-particle fuels is given along with general information on processes widely used in the field such as fluidization. Subject and author indexes are included. NSA

N66-27385# Oak Ridge National Lab., Tenn. Isotopes Development Center.
PROMETHIUM-147: RADIATION MEASUREMENTS OF A ONE-WATT, PROTOTYPE HEAT SOURCE
H. A. O'Brien, Jr. and W. D. Box Nov. 1965 18 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1177) CFSTI: HC $1.00/MF $0.50

Measurements of dose rates and bremsstrahlung spectrum of a 2763-curie, aged, $^{147}Pm_2O_3$ heat source were made under varying conditions. The ratio of ^{146}Pm to ^{147}Pm was measured and found to be 3.7×10^{-7}. Author (NSA)

N66-27417# Naval Research Lab., Washington, D. C.
IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS Quarterly Progress Report, 1 Nov. 1965–31 Jan. 1966
Lendell E. Steele, J. Russell Hawthorne, and Charles Z. Serpan, Jr. 15 Feb. 1966 43 p refs
(NRL-MEMO-1676; AD-630937) CFSTI: HC $4.60/MF $0.50

The report includes the following: (1) comparative embrittlement of several commercial and experimental steels, (2) directionality effects upon notch ductility of irradiated A212-B and A302-B steels, (3) preliminary results on the influence of microstructure on radiation sensitivity, (4) notch ductility of irradiated 304L and 347 stainless steels, (5) properties of specimens from OMRE grid plate, and (6) results of first phase surveillance of Piqua Nuclear Power Facility. Author (TAB)

N66-27462# California Univ., Livermore. Lawrence Radiation Lab.
HAZARDS CONTROL Quarterly Report No. 22, Jul.–Sep. 1965
[1965] 60 p refs
(Contract W-7405-ENG-48)
(UCRL-14534) CFSTI: HC $3.00/MF $0.75

Investigations in dosimetry, whole-body counter, and radioactive material removal for hazards control are presented. LiF energy absorption coefficient calculation, Sb–Be neutron source for dosimetry calibrations, a personnel-monitoring alarm dosimeter, and a continuous air monitor are reported. Whole-body counter facility, and airborne radon concentration effects on whole-body counter background are discussed. Vacuum methods for recovering spilled mercury and for concentrating milk prior to gamma pulse height analysis are described. A wet cyclone scrubber used to remove carbon dust from a high speed printer, a fallout isoconcentration line estimation, and electronic flash units for use near explosives are mentioned. N.E.N.

N66-27463# Oak Ridge National Lab., Tenn.
SHIPPING COST COMPARISONS FOR LEAD-SHIELDED, STEEL-SHIELDED, AND URANIUM-SHIELDED CASKS
L. B. Shappert and Royce Salmon Mar. 1966 20 p refs
(Contract W-7405-ENG-26)
(ORNL-3918) CFSTI: HC $2.00/MF $0.50

Lead-, steel-, and uranium-shielded casks were compared, based on the total cost of transporting spent fuel from a reactor to a reprocessing site 1,000 miles distant. The unique feature of the comparison was that the costs were compared not on the basis of the same fuel load for each cask, but on the same cask weight. This weight was limited to 25 tons empty weight (or as much as 29 tons loaded), which is about the maximum that can be handled in unrestricted truck-trailer shipments. The total cost, the

sum of four separate charges, included handling, freight, insurance, and cask amortization. The results of this comparison indicate that the use of uranium-shielded casks can be economically advantageous, provided that the cost of the cask can be kept in the range of $4.00 to $9.00 per pound of cask weight (empty). The greatest advantage to the reactor operator occurs if he is able to keep the cask in use 100% of the time, or rent a cask when needed.
Author (NSA)

N66-27484# Oak Ridge National Lab., Tenn.
EVALUATION AND IRRADIATION EFFECTS STUDIES ON PYROLYTIC CARBON COATED FUEL PARTICLES
J. G. Morgan, P. E. Reagan, and E. L. Long, Jr. Mar. 1966 39 p refs
(Contract W-7405-ENG-26)
(ORNL-3923) CFSTI: HC $2.00/MF $0.50

Several different types of pyrolytic carbon coated fuel particles were studied. The particles, about 500μ in dia, contained UC_2, $(U,Th)C_2$, or $(U,Th)O_2$ as the fuel core material. Two types of coatings were used, a two layer (duplex) and a three layer (triplex). Dimensions, densities, coating contamination, and coating structure were determined before irradiation. The particles chosen for the irradiation tests were from three vendors as well as ORNL. The tests were conducted in the ORR in continuously monitored sweep gas experiments. The temperatures of irradiation ranged from 1000 to 1370°C with burnups up to 20% heavy metal. Fractional fission gas release rates of from 10^{-3} to 10^{-6} were measured during irradiation. In two of the tests, about 1% of the coatings failed. The duplex coated particles had spearhead cracks and reactions at the fuel core-coating interfaces. Triplex coated particles did not show this effect. The fission gas released from intact particles appeared to be a result of U contamination in the coatings.
Author (NSA)

N66-27486*# United Nuclear Corp., Elmsford, N. Y. Research and Engineering Center.
ATHENA: A SYSTEM OF FORTRAN PROGRAMS FOR RADIATION TRANSPORT AND HEATING CALCULATIONS IN COMPLEX REACTOR GEOMETRIES Final Report
D. Spielberg Mar. 1966 89 p refs
(Contract NAS3-6200; UNC Proj. 2326)
(NASA-CR-54905; UNC-5148) CFSTI: HC $3.00/MF $0.75 CSCL 18K

ATHENA is a system of 11 coordinated programs, in FORTRAN IV for IBM-7094 and FORTRAN 63 for CDC-1604-A, for the solution of radiation transport and heating problems in complex three-dimensional geometries. Its geometry routines permit especially efficient representation of a reactor core possessing a vertical axis and hexagonal symmetry, such that any two adjacent 30-degree sectors are reflectionally symmetric with respect to the vertical plane separating them. The report describes the logic, functions, and interrelations of the component programs; in addition, operating instructions and details of the input and output for each program are given.
Author

N66-27490*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
STUDY OF NUCLEAR BRAYTON CYCLE POWER SYSTEM
S. I. Freedman 5 Aug. 1965 225 p refs Its Doc.-65SD4251
(Contract NASw-980)
(NASA-CR-54397) CFSTI: HC $8.00/MF $1.25 CSCL 18L

A parametric analysis and system optimization was made of reactor heated Brayton cycle space powerplants in the 50 to 200 KWe range. Models of gas and liquid-metal cooled reactors, shields, turbomachinery, heat exchangers, piping, and gas and liquid-metal filled radiators were synthesized. Application to manned and unmanned missions enabled evaluations to be made of reactors and shield configurations and system integration influences over a wide range of requirements. Turbomachinery performance was based on the efficiencies of the NASA/Lewis two-shaft solar Brayton system. Dependence of optimized system specific weight on shield requirements, turbine inlet temperature and power rating were determined.
Author

N66-27510# Oak Ridge National Lab., Tenn.
BONUS REACTOR SUPERHEATER FUEL ASSEMBLIES—AN INVESTIGATION OF FAILURE AND METHOD OF CORRECTION
J. E. Cunningham, E. L. Long, Jr., E. A. Franco-Ferreira, and D. G. Harman Dec. 1965 173 p refs
(Contract W-7405-ENG-26)
(ORNL-3910) CFSTI: HC $5.00/MF $1.00

A superheater assembly that incurred a fission break when accidentally subjected to a modest temperature transient during full-core testing of the BONUS Reactor at a power level of 5 Mw was examined. The techniques used to locate the source of fission-product leakage and establish the nature and extent of damage to the Inconel-clad UO_2 fuel rods are described. Significant observations made during in-cell inspection, component disassembly, gamma scanning, dimensional measurements, gas sampling and analysis, leak testing, and metallographic examination are recorded and discussed. The supporting laboratory and analytical data obtained to facilitate the identification of cause and mode of failure are presented. Fabrication studies undertaken to delineate corrective measures are described. The failure was caused primarily by leak holes that resulted in welds from a faulty welding practice that left hot cracks. Water or steam leaked into the element, so that overheating suddenly increased the pressure, rupturing the cladding.
Author (NSA)

N66-27516# Sandia Corp., Albuquerque, N. Mex.
A COMPARISON OF THE RESULTS OF THE SANDIA CORPORATION TTA TRAJECTORY PROGRAM AND THE ATOMICS INTERNATIONAL RESTORE TRAJECTORY PROGRAM
H. R. Spahr Feb. 1966 60 p refs
(Contract AT(29-1)-789)
(SC-RR-66-22) CFSTI: HC $3.00/MF $0.75

The results of the Sandia Corporation TTA and the Atomics International RESTORE trajectory programs are compared. Initial conditions used for both trajectories correspond to an orbital decay trajectory which is very sensitive to any variation in inital conditions or input data. The comparison of the results, which indicated relatively small differences between the two trajectories, verified the accuracy of the trajectory programs.
Author (NSA)

N66-27517# Sandia Corp., Albuquerque, N. Mex.
ROVER POSTOPERATIONAL DESTRUCT INSTRUMENTATION DEVELOPMENT
R. E. Berry and J. P. Martin Dec. 1965 119 p
(Contract AT(29-1)-789)
(SC-RR-65-551) CFSTI: HC $4.00/MF $1.00

Development tests in preparation for a full-scale destruct test of the ROVER/NERVA space propulsion engine are reported. The development tests furnish the following information: the debris pattern from a four-explosive-charge scale model is a four-jet pattern with the jets originating

at 45 degrees between the explosive charges; the debris size and distribution is repeatable and the size ranges from 0.5 to 4760 microns; the velocity of the debris particles is about 350 to 450 feet per second; scale models simulating the real item must be used to be assured of proper debris distribution pattern; rotating polystyrene foam particle catchers and velocity measuring devices are satisfactory and will yield the desired data; air sampling is necessary to obtain information on the particle sizes below 20 microns; 2-pound per cubic foot foam is superior for particle collection; and the pressure generated is about 50 percent of the pressure created by an uncased charge of the same weight. The development tests provide techniques, instrumentation, and physical layout information needed for performing a full-scale destruct test on a mockup ROVER/NERVA space propulsion engine. Author (NSA)

N66-27528*# Cook Electric Co., Morton Grove, Ill. Tech-Center Div.

PROPERTIES OF RADIOISOTOPE HEAT SOURCES, PART I Final Report, 25 Mar.-31 Aug. 1965

Charles R. Memhardt [1965] 203 p refs

(Contract NAS5-9156)

(NASA-CR-75439) CFSTI: HC $6.00/MF $1.25 CSCL 18N

A report outlining the best available unclassified information on the nuclear, chemical, and physical properties of nine SNAP isotopes was prepared. The isotopes reviewed are: Sr-90, Cs-134, Cs-137, Ce-144, Pm-147, Po-210, Pu-238, Cm-242, Cm-244. The properties reviewed were (1) Half Life; (2) Neutrons/Spontaneous Fission; (3) Neutrons from Spontaneous Fission; (4) Other sources of Radiation; (5) Energy Levels and Decay Schemes; (6) Fuel Forms; (7) Material Compatibility; (8) Effects of Impurities; (9) Thermal Conductivity; (10) Power Density; (11) Specific Power; (12) Heat Capacity; (13) Heat of Fusion; (14) Weight Density; (15) Melting Point; (16) Boiling Point; (17) Specific Activity; (18) Isotope Production, Availability, and Cost. At the end of each isotope section an annotated bibliography pertaining to that isotope is presented. Author

N66-27550# Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev.

EXPERIMENTAL RADIATION MEASUREMENTS IN CONVENTIONAL STRUCTURES, PART III: THE ATTENUATION OF AIR-SCATTERED RADIATION IN A BASEMENT

Z. G. Burson Nov. 1965 78 p refs

(Contract AT(29-1)-1183)

(CEX-59.7B, Pt. 3) CFSTI: HC $1.00/MF $0.75

An experimental study was conducted to determine the air-scattered radiation contribution to a basement structure from a simulated plane source of ^{60}Co on the ground outside and to determine its attenuation through various structural components. A sealed radioactive source was used to simulate both an area and a ring source. Exposure measurements were made with ionization chamber detectors. A bare, open basement was used as the basic structure. Radiation measurements were made in the open basement; within shelter walls constructed in one end of the basement; within these shelter walls surrounded by sandbags; in the fully constructed shelter with no sandbags; in both the basement and shelter after a wood roof was constructed over the entire basement; in the basement and shelter after a 4-in. layer of concrete planks was placed over the wood roof; and in the basement and shelter after an 8-in. layer of concrete planks was placed over the wood roof. The top of the materials (basement walls, wood roof, or concrete planks) was flush with ground level. This assured that radiation reaching the detectors had been scattered at least once in the air. Comparisons were made with data taken in a similar basement below a two-story brick house. Author (NSA)

N66-27563# Battelle-Northwest, Richland, Wash. Pacific Northwest Labs.

EVALUATION OF RADIOLOGICAL CONDITIONS IN THE VICINITY OF HANFORD, JANUARY-JUNE 1965

R. H. Wilson, ed. 6 Dec. 1965 29 p refs

(Contract AT(45-1)-1830)

(BNWL-165) CFSTI: HC $2.00/MF $0.50

Surveillance of the Hanford environs during the first half of 1965 showed that the amounts of radioactive materials present during this period were well within the nationally accepted limits at all times and that releases of radioactive materials from the Hanford plant were adequately controlled. ^{32}P released with Hanford effluent in the Columbia River continued to be the radioisotope that contributed the most exposure to individuals who ate locally caught fish in quantity. Author (NSA)

N66-27580# Massachusetts Inst. of Tech., Cambridge.

NONDESTRUCTIVE ANALYSES OF IRRADIATED MITR FUEL BY GAMMA-RAY SPECTROSCOPY Scientific Report No. 4

Jerry A. Sovka (M.S. Thesis) and Norman C. Rasmussen Bedford, Mass., AFCRL, Oct. 1965 266 p refs

(Contract AF 19(604)-7492)

(MITNE-64; AFCRL-65-787; AD-631341) CFSTI: HC $6.00/MF $1.25

Lithium drifted Ge solid state gamma ray detectors were developed and applied to the problem of nondestructive analysis of spent reactor fuel. The energy resolution of the detector was better than 1% (FWHM) in the 600 to 800 keV range and made possible the identification of gamma rays from Co-134, Cs-137, Rh-106, Nb-95, and Zr-95 in this energy region. Ratios of intensities of these gamma rays were used to determine average flux and irradiation time of the fuel. The burnup was then calculated. Results of these measurements agreed with other independent measurements well within the 10% error assigned. The technique developed provides a useful method for determining the irradiation history of spent reactor fuel that has been operated at low enough temperatures so that fission product migration has not taken place. Author (TAB)

N66-27887# Naval Civil Engineering Lab., Port Hueneme, Calif.

DOSE-ATTENUATION VARIATION WITH INCIDENT GAMMA-RAY ENERGY IN TWO-LEGGED CONCRETE AND STEEL DUCTS

J. M. Chapman Apr. 1966 20 p refs

(TR-R-442; AD-630697) CFSTI: HC $2.00/MF $0.50

Gamma ray dose attenuation factors were measured in concrete and steel ducts. For concrete, 3-foot-square and 11-inch-square ducts were used with Au^{198} (0.412 MeV), Cs^{137} (0.662 MeV), and Co^{60} (1.25 MeV) gamma ray sources. Attenuation factors for given geometries were compared as a function of incident gamma ray energy. The relative effectiveness of steel and concrete ducts of a given geometry was determined. The attenuation factor decreases monotonically with increasing energy in concrete ducts. In the 11-inch-steel duct the attenuation factor for the high energy source (Co^{60}) was greater than for the low-energy source (Cs^{137}). In comparing the 11-inch concrete and

11-inch steel ducts, it was found that dose rates in the concrete duct were higher by a factor of about 2. Measured attenuation factors were compared with values obtained using a computer code based on the albedo concept. It was found that calculated attenuation factors agree to within ±30% of the measured attenuation factors. Author (TAB)

N66-27906# Argonne National Lab., Ill.
A NEW TECHNIQUE FOR EXPERIMENTAL INVESTIGATION OF HIGH-TEMPERATURE THERMAL DIFFUSIVITY OF URANIUM DIOXIDE UNDER TRANSIENT CONDITIONS
Leslie D. Montgomery Nov. 1965 43 p refs
(Contract W-31-109-ENG-38)
(ANL-7116) CFSTI: HC $2.00/MF $0.50

Two UO_2 rods of different ^{235}U enrichment are bonded end to end. The combined rod is then exposed to a uniform, intense burst of neutron radiation, causing a temperature rise in each portion that is approximately proportional to its respective enrichment. The heat within the sample is generated internally by the fission process. By means of two thermocouples embedded within the rod a certain distance from the interface, the temperature difference between the two thermocouple positions can be measured as a function of time. If the temperature difference at a certain time is known, the thermal diffusivity of the sample may be determined by means of a formula. Another method from the same experiment involves measuring the slope of the photographic data trace. NSA

N66-27908# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.
IN-TANK IRRADIATION FACILITIES AT THE TEST REACTOR AREA (STANDARD PRACTICES GUIDE)
R. L. Ackaret and A. S. Richardson Jan. 1966 83 p Supersedes IDO-16428
(Contract AT(10-1)-205)
(IDO-17135) CFSTI: HC $3.00/MF $0.75

An aid is presented for planning and designing capsule experiments for irradiations in the Test Reactor Area (TRA) facilities. Facilities available for capsule irradiations are described. Standard capsules and capsule holders or baskets are also described. A generalized discussion of typical designs of various types of capsules is included. In addition, the requirements for irradiation of capsule experiments are presented. Author (NSA)

N66-27911# Mound Lab., Miamisburg, Ohio.
GAMMA SHIELDING REQUIREMENTS FOR PLUTONIUM-238 AND POLONIUM-210 (REVISED)
K. W. Foster 21 Jan. 1966 10 p refs Supersedes MLM-1200
(Contract AT(33-1)-GEN-53)
(MLM-1315; MLM-1200) CFSTI: HC $1.00/MF $0.50

Gamma shielding requirements were computed for Pu^{238} and Po^{210}. Literature values were used for the gamma energies, their relative abundances, and for the mass absorption coefficients of these decay components in various shielding materials. A point source and isotropic radiation were assumed; self-absorption was not considered. For Pu^{238}, the greatest shielding thicknesses were required to attenuate the 780-keV component. The following shielding thicknesses are required to reduce the dose rate from a bare 1-kg Pu^{238} source to less than 2.5 mR/hr at 1 m: 0.85 cm lead, 2.30 cm iron, 0.45 cm uranium, and 10.6 cm concrete. The gamma radiation intensities were computed for 100-w, 1-kw, and 10-kw Po^{210} heat sources. The thicknesses of uranium required to attenuate the 0.802-MeV gamma radiation from each of the above sources to 1000, 100, 10.0, and 1.0 mR/hr at 1 m were calculated. Author (NSA)

N66-27913# Bettis Atomic Power Lab., Pittsburgh, Pa.
EVALUATION OF LOW DENSITY SINGLE-PHASE CUBIC ZrO_2+UO_2 FUELS STABILIZED WITH CaO
H. R. Warner Jan. 1966 51 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-292) CFSTI: HC $3.00/MF $0.50

The addition of CaO to stabilize the crystal structure of ZrO_2–UO_2 fuels was shown to improve significantly the in-pile characteristics of ZrO_2-base fuels from a plate stability viewpoint, and from retention of porosity, which is necessary to accommodate fuel swelling to exposures of approximately 30×10^{20} fissions/cm^3. The ZrO_2–41.1 wt % UO_2–6.1 wt % CaO fuel exhibited a substantial reduction in the amount of permanent clad depression over that of the ZrO_2–37.2 wt % UO_2 fuel. Experimental techniques were developed for metallographic determination of the total clad depression under in-pile operating conditions, and the fuel thickness decreases measured. Results indicate that the highly plastic two-phase tetragonal ZrO_2–UO_2 fuels are significantly strengthened by the addition of CaO. This strengthening is attributed to the initial single-phase cubic crystal structure imparted by the CaO addition. The minimum flow stress for 90% dense UO_2 and ZrO_2–UO_2–CaO was estimated to be at least 1400 psi, while the apparent flow stress of the 90% dense two-phase tetragonal ZrO_2–UO_2 was 800 to 1000 psi. Lineal analysis of the retained fine porosity indicates that for ZrO_2–UO_2 fuels, the fine porosity was eliminated prior to 1.23×10^{20} fissions/cm^3, while at an exposure of 1.55×10^{20} fissions/cm^3, the addition of CaO to ZrO_2–UO_2 substantially reduces the rate of closure of the fine porosity, with approximately one-third of the initial fine porosity retained. The reduction in the amount of fine porosity is attributed to an in-pile sintering phenomenon, although the exact mechanism is undiscernible in this particular test. Lineal analysis of retained coarse porosity indicates that the closure of coarse porosity of the ZrO_2–UO_2 fuels is strongly dependent on the force transmitted by the cladding to the fuel from the system pressure, whereas for the CaO-stabilized ZrO_2–UO_2, no closure of the coarse porosity was observed. This is attributed to the initial crystal structure of the two materials. The anisotropic ZrO_2–UO_2 crystal structure is affected by fission spikes in-pile such that internal stresses are continuously produced between grains, and then relieved by enhanced creep. The CaO-stabilized ZrO_2–UO_2 cubic structure, as well as the single-phase cubic UO_2 structure, although having enhanced plasticity due to stress relaxation within the thermal spikes generated in-pile, exhibits a smaller enhancement of the creep rate since this latter phenomenon is less effective. The small dimensional change observed in both the UO_2 and ZrO_2–UO_2–CaO fuels observed in the test are attributed to an in-pile sintering phenomenon. Author (NSA)

N66-27914# Mound Lab., Miamisburg, Ohio.
RADIOISOTOPES FOR HEAT SOURCES. II: CALCULATIONS FOR PREPARATION OF Ac_{227} BY NEUTRON IRRADIATION OF Ra_{226}
K. W. Foster 1 Jul. 1965 11 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1297) CFSTI: HC $1.00/MF $0.50

The advantages and disadvantages in the use of actinium-227 as a nuclear heat source material are discussed, and

the calculation of optimum neutron irradiation schemes to produce actinium-227 from radium-226 is described. The chief advantages in the use of actinium-227 are the relatively high power density resulting from five alpha-active daughters, and a relatively long half life giving a stable heat output for many years. The chief disadvantages are intense gamma radiation from the various daughters in the decay chain, and low abundance of the starting material, radium-226. Irradiation schemes were optimized to conserve radium rather than for maximum actinium productivity. At present the disadvantages appear to outweigh the advantages for heat source applications. Author (NSA)

N66-27919# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
DETERMINATION OF MAXIMUM NUCLEAR TUBE POWERS BASED ON BOILING BURNOUT
G. M. Hesson Dec. 1965 17 p refs
(Contract AT(45-1)-1830)
(BNWL-176) CFSTI: HC $1.00/MF $0.50

A method is described to define the maximum tube power of a pressure tube reactor as limited by boiling burnout. The method divides all those factors involved in a boiling burnout analysis into two groups and a factor called a consequence factor. The two groups consist of: those whose value and effect can be defined with reasonable accuracy, and those whose value or effect is uncertain but which must be estimated. The consequence factor is determined from an assessment of the consequences of boiling burnout. These factors and the relation they impose between the boiling burnout heat flux and the average heat flux derived from the measured tube power are presented. NSA

N66-27920# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
PROPOSED TUBE POWER LIMITS FOR THE PRTR 58-INCH MK I FUEL ELEMENT
G. M. Hesson Dec. 1965 19 p refs
(Contract AT(45-1)-1830)
(BNWL-177) CFSTI: HC $1.00/MF $0.50

The factors that affect the possibility of the occurrence of boiling burnout were evaluated. The numerical values assigned to the factors were used to calculate the boiling burnout tube power limit for several flow rates and inlet coolant temperatures. NSA

N66-27921# Battelle Memorial Inst., Columbus, Ohio.
PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING NOVEMBER, 1965
Russell W. Dayton and Stan J. Paprocki 1 Dec. 1965 25 p
(Contract W-7405-ENG-92)
(BMI-1751) CFSTI: HC $2.00/MF $0.50

Progress in studies on fuels, reactor materials and components, uranium–plutonium mononitride fuel materials, coated-particle fuel materials, and corrosion of structural materials used in the fluidized-bed fluoride-volatility process is reported. NSA

N66-27923# Battelle Memorial Inst., Columbus, Ohio.
PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING DECEMBER, 1965
Russell W. Dayton and Stan J. Paprocki 1 Jan. 1966 25 p refs
(Contract W-7405-ENG-92)
(BMI-1754) CFSTI: HC $2.00/MF $0.50

Progress in studies on fuels, reactor materials and components, uranium plutonium mononitride fuel materials, coated-particle fuel materials, and corrosion of materials used in the fluidized-bed fluoride-volatility process is reported. NSA

N66-27941*# General Dynamics/Fort Worth, Tex. Nuclear Aerospace Research Facility.
MONTE CARLO CALCULATIONS OF ENERGY DEPOSITIONS AND RADIATION TRANSPORT. VOLUME 1: VALIDATION OF COHORT CODES
D. G. Collins and T. W. De Vries 21 Dec. 1965 31 p refs
(Contract NAS8-5182)
(NASA-CR-75629; FZK-176-1) CFSTI: HC $2.00/MF $0.50
CSCL 18 K

A Monte Carlo procedure for the IBM 7090 digital computer has been developed to perform calculations of the radiation heating in propellant tanks and the radiation environment about a nuclear rocket stage. The procedure is made up of seven codes. These codes generate primary-source-particle parameters, neutron and gamma-ray histories, and secondary-gamma-ray source parameters. The codes will also analyze the history data so that the particular quantities desired as answers to a given problem may be determined. The results from the Monte Carlo codes are compared with other calculations of the heat deposition in liquid hydrogen and with calculations and measurements of the angular distribution of a fast-neutron dose rate transmitted through a 9-inch polyethylene slab. Information reported includes sources of the cross-section data gathered in preparation for a flux leakage calculation from a NERVA-type engine. Author

N66-27959*# Oak Ridge National Lab., Tenn. Radiation Shielding Information Center.
ABSTRACTS OF THE LITERATURE EXAMINED BY THE RADIATION SHIELDING INFORMATION CENTER (SPACE AND ACCELERATOR SHIELDING)
(1965) 48 p refs
(NASA Order R-104)
(NASA-CR-75575; ORNL-RSIC-12) CFSTI: HC $2.00/MF $0.50
CSCL 18F

The abstracts included here cover all the space and accelerator shielding documents that are both in the literature store of the Radiation Shielding Information Center and in the initial edition of an RSIC bibliography in these fields. The bibliography, ORNL-RSIC-11, *Bibliography, Subject Index, and Author Index of the Literature Examined by the Radiation Shielding Information Center (Space and Accelerator Shielding), November 1965*, is being issued along with these first 99 abstracts. Although most of the abstracts included here were taken directly from the published documents, some were written by the reviewers for RSIC. These were limited to documents which either did not contain abstracts or contained abstracts that were not sufficiently informative. Only unclassified abstracts are included; all are subject to revision or replacement. At the lefthand margin next to each abstract is an RSIC accession number for the document itself. Indexes to the abstracts both by subject matter and by author can be found in the bibliography. Author

N66-27982# Atomic Energy Establishment, Winfrith (England). Reactor Development Div.
METHODS OF DETECTING THE ONSET OF BURN-OUT IN ROD CLUSTERS
D. J. Adnams, K. J. Salt, and C. A. Wintle Dec. 1965 37 p refs
(AEEW-R-432) HMSO: 5s 6d

The report describes experimental investigation of the relative performance of various types of detector element for use inside a water cooled test section under typical burn-out conditions. The types of detector element include thermopile and resistance elements based on either heat conditions or radiation principles. Author

N66-28017*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IRRADIATION SYSTEM FOR CRYOGENIC EXPERIMENTS IN THE PLUM BROOK REACTOR
F. A. Haley and R. R. Wyer Washington, NASA, 1966 27 p refs Presented at the Intern. Symp. on Develop. in Irradiation Capsule Technol., Pleasanton, Calif., 3–5 May 1966 Sponsored by AEC and GE
(NASA-TM-X-52203) CFSTI: HC $2.00/MF $0.50 CSCL 18I

This paper describes an irradiation system that is suitable for certain experiments planned for the Plum Broom Reactor (PBR) in support of the nuclear rocket effort. The system consists of an experiment capsule assembly for holding experiment packages, an insertion system for placing the experiment capsule in the PBR, a data acquisition system for recording experiment data and controlling the experiment, and a cryogenic helium system for cooling and actuating experiments. A brief description of the PBR is also included. R.N.A.

N66-28041*# Lockheed Nuclear Products, Marietta, Ga.
EFFECT OF NUCLEAR RADIATION ON MATERIALS AT CRYOGENIC TEMPERATURES Quarterly Report No. 3, 21 Jan.–21 Apr. 1966
C. A. Schwanbeck May 1966 94 p refs
(Contract NAS3-7985)
(NASA-CR-54976; LAC-ER-8538) CFSTI: HC $3.00/MF $0.75 CSCL 18J

The combined effects of fast neutron irradiation and a cryogenic environment on the mechanical properties of high purity aluminum, aluminum alloys, high purity titanium, and titanium alloys was investigated. The following tests were performed: (1) irradiations to 10^{18} nvt (E 0.5 MeV) at 30°R; (2) irradiations to 10^{17} nvt at temperatures between 30° and room temperature; and (3) irradiations to 10^{17} nvt at 30°R, followed by specimen warm-up prior to fracture. Based on the results, it is reported that the temperature dependence of the F_{ty}/F_{tu} ratio in high purity aluminum is attributable to changes in intergranular critical shear stress; and that the tensile and yield strengths of high purity titanium increase under integrated fluxes up to 10^{19} nvt. The complete test data to date are tabulated; and the test equipment is described in detail. D.T.

N66-28095# Atomic Energy Establishment, Winfrith (England). Fast Reactor Physics Div.
REACTOR PERTURBATION CALCULATIONS BY MONTE CARLO METHODS
M. E. Gubbins Sep. 1965 30 p refs
(AEEW-M-581) HMSO: 4s

It is difficult to apply Monte Carlo methods to the calculation of perturbation worths because of the large amount of computing time needed to obtain good accuracy. Various ways of overcoming these difficulties are investigated in this report, particularly the problem of estimating absorbing control rod worths. A method of carrying out multigroup reactor calculations by Monte Carlo methods is described. Two methods of estimating a perturbation worth directly, without differencing two quantities of like magnitude, are examined closely but are passed over in favor of a third method based on a correlation technique. This correlation method is described and demonstrated by a limited range of calculations for absorbing control rods in a fast reactor. In these calculations control rod worths of between 1% and 7% in reactivity are estimated to an accuracy better than 10% (3 standard errors) in about one hour's computing time on the English Electric KDF.9 digital computer. Author

N66-28096# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
RESEARCH ON THE USE OF ORGANIC COOLANT-MODERATORS IN NUCLEAR POWER REACTORS
[1965] 320 p refs Transl. into ENGLISH of the book "Issledovaniya po Primeneniyu Organicheskikh Teplonositelei-Zamedlitelei v Energeticheskikh Reaktorakh" Moscow, Atomizdat, 1964
(AECL-2330) CFSTI: HC $7.00/MF $1.75

Radiochemical, thermophysical, and neutron-physical properties of organic coolants are considered in relation to the development and use of nuclear power reactors. The use of a gas oil fraction of a natural oil as a coolant is shown to be feasible, and various organic coolant moderators are discussed. Attention is given to heat transfer to organic liquids, critical heat fluxes during boiling, and changes in thermophysical properties. The corrosive action of diphenyl on metals and their oxides is investigated; as are diffusion of thermal neutrons for some organic compounds, scattering of slow monochromatic neutrons in mono–isopropyldiphenyl, and determination of thermal neutron spectra in a uranium–mono–isopropyldiphenyl lattice. Other chapters in this book consider the hydrogenative regeneration of organic coolants, the use of organic coolants in nuclear power installations, and obtaining organic coolants from residues in the manufacture of cumyl or isopropylbenzene. M.W.R.

N66-28097# United Kingdom Atomic Energy Authority, Harwell (England). Chemical Engineering Div.
PROCESSING IN LIMITED GEOMETRY, PART 16: THE HYDRAULIC LIFTING OF SOLIDS FROM A CONTINUOUS DISSOLVER FOR NUCLEAR FUEL
G. S. Larner, K. W. Carley-Macauly, and R. J. Moulton Feb. 1966 42 p refs
(AERE-R-5104)

This paper describes work relating to the continuous leaching of sheared fuel elements or similar material in a vertical tube dissolver. In such a dissolver, the problem arises of continuously removing the undissolved pieces of fuel can from the base of the dissolver tube. This may be achieved by using a hydraulic lift device to carry the cans to above the free liquid surface, while the actual disengagement at the dissolver tube base is controlled by a pulsing action. Two hydraulic lift devices, an air-lift and a pulsed ladder, were tested using water as the working fluid to lift solids and lengths of sheared tube up to 0.5 in diameter and 0.5 in length. Data are presented on the lift requirements as pulse magnitude or air flow for different solids, and on the control of lifting rates in the air lift by using a pulsed box. The possibility of washing cans during transport was also investigated. Reliability of operation is discussed in relation to the dimensions of the equipment. It is concluded that for fuel dissolution application, the advantages of the pulsed ladder are insufficient to justify its greater structural complexity compared to the air-lift device, which worked well with a variety of solids. Author

N66-28099# European Atomic Energy Community, Brussels (Belgium). Engineering Dept.
IN-PILE APPLICATION OF STRAIN GAUGES—PRELIMINARY RESULTS
P. Weltevreden Apr. 1966 30 p refs
(EUR-2649.e) CFSTI: HC $2.00/MF $0.50

This paper describes the first stage of an irradiation program on resistance strain gauges. The scope of this program is to establish limits on the use of resistance strain gauges in a radioactive environment. To this extent a number of strain gauges is attached to a tube-section in various compensating arrangements. The tube section is mounted inside an irradiation rig and subsequently introduced in a reflector position of a CP-5 type reactor. The report gives a detailed description of the irradiation device and summarizes the data in the form of strain gauge parameters versus integrated neutron flux. Definite conclusions concerning irradiation stability are given and the continuation of the irradiation program is outlined. Author

N66-28102# Reactor Group, United Kingdom Atomic Energy Authority, Culcheth (England). Reactor Materials Lab.
FAST-NEUTRON RADIATION-INDUCED CHANGES IN POLYCRYSTALLINE ALUMINA
R. P. Thorne and V. C. Howard 1966 19 p refs
(TRG-1137(C))

Polycrystalline alumina specimens of between 5 and 30% porosity have been irradiated to fast-neutron doses up to 16×10^{20} nvt at 250°, 475° and 700° C. At the two lower irradiation temperatures specimen length and thermal resistivity increased at a decreasing rate with dose. The increase in length and fractional decreases in thermal conductivity were 0.5% and 5 for a dose of 11×10^{20} nvt at 250° C, and 0.4% and 2 for a dose of 16×10^{20} nvt at 475° C, respectively. At low doses the macroscopic volume changes and lattice volume changes were identical. At higher doses the macroscopic growth is significantly greater than the lattice growth, and is believed to be caused by the temperature-dependent diffusion of interstitial defects to form clusters outside the unit cell. After relatively short irradiations at 700° C, 30% porous alumina cracked with an accompanying high bulk growth. Denser sintered specimens increased by 0.15% in length on irradiation at 700° C to a dose of 8×10^{20} nvt, but on further irradiation cracked. The cracking of alumina specimens at 700° C is believed to be caused by micro-cracks generated by either irradiation or thermal effects. Marginal decreases in Young's modulus were recorded. Within experimental limits the coefficient of thermal expansion was unaffected by irradiation. Author

N66-28107# Atomic Industrial Forum, Inc., New York.
NUCLEAR FUEL CYCLE SEMINAR
Sidney M. Stoller, Roger J. Coe, and A. Payne Kibbe Jan. 1966 35 p refs Seminar held 17 Jan. 1966

This report discusses some of the proceedings of the Nuclear Fuel Cycle Seminar sponsored by the Atomic Industrial Forum, Inc. The seminar was conducted to survey the U.S. uranium market, in particular to collect facts concerning U.S. experience in finding and producing uranium and on the current status of the uranium industry; to establish uranium price futures which are needed to analyze future atomic fuel costs; and to develop ideas, from the utility viewpoint, about possible future patterns of uranium buying. Conclusions and comments on this survey are presented. R.N.A.

N66-28141# Atomic Energy Establishment, Winfrith (England). General Reactor Physics Div.
A COMPARISON OF MEASUREMENTS ON PuO_2-UO_2 FUELED GRAPHITE LATTICES WITH CALCULATIONS USING THE ARGOSY METHOD
D. C. King Jan. 1966 52 p refs
(AEEW-R-466) HMSO: 7s

The predictions of the ARGOSY method of calculation are compared with buckling and reaction rate measurements on graphite lattices containing plutonium enriched oxide cluster fuels. It is shown in this report that the buckling predictions of ARGOSY III at room temperature are in agreement with the experimentally determined values within approximately the experimental error, i.e., equivalent to ±0.5% in reactivity. When systematic errors are removed, however, a linear trend with the fraction of fissions occurring in Pu^{239} is evident; the calculated reactivity being (0.6 ±0.3)% low for zero Pu^{239} content and (0.6 ±0.3)% high for fuel with 80% of fission occurring in Pu^{239}. The experimentally determined change of buckling between 20 and 390°C is predicted to within the experimental error, i.e., equivalent to ±0.7 mn/°C. Reaction rate ratios and radial power distributions at all temperatures are predicted well by ARGOSY III. Author

N66-28143# Aktiebolaget Atomenergi, Stockholm (Sweden).
THE RADIOACTIVE WASTE MANAGEMENT AT STUDSVIK
R. Hedlund and A. Lindekog Apr. 1966 18 p refs Presented at IAEA Panel on Econ. of Radioactive Waste Management, Vienna, 13–17 Dec. 1965
(AE-225) CFSTI: HC $1.00/MF $0.50

The report was originally prepared as a contribution to the discussions in an IAEA panel on economics of radioactive waste management held in Vienna from 13–17 December 1965. It contains the answers and comments to the questions of a questionnaire for the panel concerning the various operations associated with the management (collection, transport, treatment, discharge, storage, and operational monitoring of: (1) radioactive liquid wastes, except high-level effluents from reactor fuel recovering operations; (2) solid wastes, except those produced from treatment of high-level wastes; (3) gaseous wastes produced from treatment of the foregoing liquid and solid wastes; (4) equipment decontamination facilities and radioactive laundries. Author

N66-28170# Atomic Energy Establishment, Winfrith (England). General Reactor Physics Div.
BUCKLING AND REACTION RATE MEASUREMENTS IN GRAPHITE MODERATED LATTICES FUELED WITH PLUTONIUM–URANIUM OXIDE CLUSTERS AT TEMPERATURES UP TO 400°C
D. H. Carter, M. Gibson, D. C. King, J. Marshall, B. J. Puckett et al Jul. 1965 154 p refs
(AEEW-R-438) HMSO: 20s

The report describes a series of experiments carried out in SCORPIO I and II on sub-critical graphite moderated lattices fueled with 21-rod clusters of PuO_2/UO_2 fuel. Three fuel batches with nominal plutonium–uranium ratios of 0.25%, 0.8% and 1.2% were investigated at temperatures between 20°C and 400°C. Because of the limited amounts of the three fuels, exponential measurements were made in 2-zone stacks, the outer regions of which were loaded with suitably matched 'reference fuel'. Fine structure distributions in the lattice cell were obtained with manganese and indium foils. Pu239/U235 fission ratios were determined both by fission chambers and by fission-product counting techniques. Author

N66-28172# United Kingdom Atomic Energy Authority, Windscale (England). Reactor Development Lab.
AN EXTENSION OF THE WESTCOTT FLUX CONVENTION TO A.G.R. TYPE SYSTEMS
J. Sherwin 1966 36 p refs
(TRG-1099(W))

The introduction of more basic methods of calculating thermal neutron spectra has led to the abandonment of the correlated method approach for the calculation of lattice data. The correlated approach, however, still has some advantages in the analysis of foil spectrum measurements in that it provides fitting parameters which can be used to compare different lattice configurations. The present report discusses a method which has advantages over the conventional Westcott definition of cell flux in that the heterogeneous nature of the fuel cell is retained in the form of cell moderator and cell fuel region. The basis of the method is to define a third parameter R in addition to the usual r,T parameters defined by Westcott. This parameter R is characteristic only of the fuel region and can be interpreted as a measure of the mean chord length in the fuel region. The report indicates how R can be measured experimentally and used to predict fuel reaction rates. The use of cadmium filters to measure the Westcott spectrum parameters is discussed. Author

N66-28192# Atomic Energy Establishment, Winfrith (England). Fast Reactor Physics Div.
DOPPLER COEFFICIENT MEASUREMENTS IN ZEBRA CORE 5
A. R. Baker and R. C. Wheeler Nov. 1965 37 p refs
(AEEW-R-465) HMSO: 4s 6d

Measurements using a central hot loop in ZEBRA core 5 are described. Results are given for the Doppler coefficients found in a number of assemblies with PuO_2 and 16% PuO_2/84% depleted UO_2 pins, loaded with different combinations of steel, sodium or void pins. The mixed oxide results are in general about 20% more negative than was calculated using the FD2 data set, but agreement is good if the plutonium contributions in the calculations are omitted. The small positive Doppler coefficient calculated for Pu239 was not observed, and two measurements indicated instead a small negative effect. The Doppler effect in the mixed oxide systems was found to vary approximately as 1/T. The results from the empty loop and non-fissile assemblies indicate either a small negative Doppler effect in steel or alternatively the presence of an unexplained expansion effect. Author

N66-28194# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Reactor Loops Branch.
THE DEVELOPMENT OF STEAM-WATER REACTOR LOOPS AT CHALK RIVER
J. C. Horsman Apr. 1966 27 p refs Presented at the Intern. Symp. on In-Pile Irradiation Equipment and Tech., Harwell, England, 10-12 May 1966
(AECL-2415) CFSTI: HC $2.00/MF $0.50

A small pressurized-water loop was modified to provide for cooling with superheated steam. It was re-designed to also accommodate boiling water and fog coolant. Several problems in steam generation, control stability, degassing, out-leakage and pumping were overcome. The experience provided a basis for the design of a large steam-water loop, U-1, that was added to the reactor; this system handles from 1 to 4 MW of nuclear heat, depending on the cooling mode. These two loops are now fully operational and, in most respects, meet the requirements. U-1 has excellent control stability over a range of conditions. It is difficult to degas to low concentrations, and persistent leakage from small valves is also a continuing problem. Improvements are needed in design and in component reliability to reduce complexity, maintenance and capital costs. Author

N66-28223# United Kingdom Atomic Energy Authority, Harwell (England). Chemistry Div.
ROUTINE USE OF THE SILVER-COBALT ACTIVITY RATIO METHOD TO DETERMINE EPITHERMAL INDICES FOR LARGE NEUTRON DOSE IRRADIATIONS
M. J. Cabell and M. Wilkins Feb. 1966 35 p refs
(AERE-R-5122) HMSO: 4s 6d

A new determination of s_o for the reaction $Ag^{109}(n,\gamma)Ag^{110m}$ is described. The result is that $s_{o'Ag}=18.53\pm0.16$, relative to $s_o=17.02$ for gold. This corresponds to an absolute value of $s_{o'Ag}=18.53\pm0.69$. The activity ratio normalization factor P is determined for silver-aluminium alloy and cobalt-aluminium alloy monitor wires. Using the counting equipment described, P is 0.2588 ±0.0004. The results are used in comparing measurements of $x=r\sqrt{T/T_o}$ by the silver-cobalt activity ratio method, with similar measurements by the gadolinium ratio method. For neutron doses ($i=(nv_o)t$) of the order 4×10^{17} n/cm^2, the results are in good agreement. A measurement of x for an irradiation of 183 days duration in the lattice of PLUTO is also described. It is concluded that the silver-cobalt activity ratio method is capable of giving x with an accuracy of better than ±5 percent when $0.1<x>0.008$ and $i<10^{20}$n/cm^2; outside these ranges the error can be larger. In addition SILCO, a computer program written in Fortran for the S2 compiler on the IBM 7030 (Stretch) computer is described. Author

N66-28226# Atomic Energy Establishment, Winfrith (England). Technical Assessments and Services Div.
SALAMANDER—A FORTRAN PROGRAM FOR REACTOR FUEL CYCLE CALCULATIONS
M. J. Brinkworth and J. Raith Sep. 1965 26 p
(AEEW-R-2660) HMSO: 3s 6d

Salamander is a Fortran program which performs reactor fuel cycle calculations in 20 or fewer energy groups for a homogenized core on a uniform flux model. Fuel costs are calculated by a new method. Author

N66-28230# Atomic Energy Establishment, Winfrith (England). General Reactor Physics Div.
FURTHER BUCKLING MEASUREMENTS ON A HEATED GRAPHITE LATTICE FILLED WITH 0.8% PuO_2/UO_2 CLUSTERS
D. J. Wilson 1966 32 p refs
(AEEW-R-464) HMSO: 4s 6d

The buckling of a graphite moderated stack fueled with 0.8% PuO_2/UO_2 21 rod clusters in a 14" lattice pitch has been measured by the exponential method. The stack was built in the SCORPIO I facility which enabled the experiments to be made at 200°C and 390°C as well as at ambient temperature. The experimental results are shown to be in very satisfactory agreement with predictions using the ARGOSY IV method. Author

N66-28231# United Kingdom Atomic Energy Authority, Dounreay (Scotland). Experimental Reactor Establishment.
THE EQUATION OF STATE OF URANIUM DIOXIDE AT HIGH TEMPERATURES AND PRESSURES
D. C. Menzies 1966 20 p refs
(TRG-1119/D/) HMSO: 2s 6d

The equation of state of uranium dioxide is derived by the method of corresponding states from the tabulated universal data of Hougen, Watson and Ragatz. The results are presented in the form of tables, graphs, and empirical relations which fit the data in the regions of interest to studies of fast reactor accidents. Results cover temperatures up to 20,000° K and pressures up to 20,000 atm. Author

N66-28234# Reactor Group, United Kingdom Atomic Energy Authority, Culcheth (England). Reactor Materials Lab.
SOLUBILITY OF SALTS IN SUPERCRITICAL STEAM
P. B. Longton 1966 78 p refs
(TRG-1136/C/)

Various inorganic materials which are normally regarded as being insoluble in steam can exhibit appreciable solubilities in this fluid at high temperatures and pressures, this effect being especially pronounced in the supercritical region. In this report the general implications of this phenomenon are reviewed, with particular reference to the development of a supercritical-steam-cooled reactor. The report includes a review of the basic principles of solubility, a summary of the available experimental data, and an account of the predominantly American and Russian experience with supercritical pressure steam plants. Author

N66-28236# United Kingdom Atomic Energy Authority, Harwell (England). Chemistry Div.
STUDY OF THE EXCHANGE OF CARBON-14 BETWEEN ^{14}CO AND CO_2 IN THE DIDO REACTOR
D. A. Dominey, H. Morley, and R. J. Waite Feb. 1966 28 p refs
(AERE-R-5046)

A series of mixtures of ^{14}CO and CO_2 has been passed through a stainless steel apparatus containing an unlabeled graphite sample in DIDO. The number of $^{14}CO_2$ molecules formed per unit dose is independent of (a) total gas pressure from 20–292 p.s.i.g., (b) CO concentration from 0.61 to 1.94%, (c) graphite temperature between 100° and 250°C, and (d) stainless steel temperature between 60° and 250°C. It is suggested that the reaction is probably suitable for dosimetric purposes under these conditions, provided a reliable absolute G value can be established. Author

N66-28326# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf (Austria). Reaktorzentrum.
THE MANUFACTURE OF SPHERICAL NUCLEAR FUEL PARTICLES OUT OF AQUEOUS METALLIC SALT SOLUTIONS [DIE HERSTELLUNG SPHAERISCHER KERNBRENNSTOFFTEILCHEN AUS WAESSERIGEN METALLSALZLOESUNGEN]
H. Bildstein, K. Knotik, and P. Leichter Mar. 1966 28 p refs In GERMAN Submitted for Publication
(SGAE-CH-29/1966) CFSTI: HC $2.00/MF $0.50

Carbide and mixed carbide nuclear fuel particles were produced from aqueous metallic salt solutions and from colloidal salt solutions in an effort to economize the regeneration of such fuels. The spherical particles were stabilized with synthetic resin compounds. Soot was used to coat the oxide particles during carburetion and fusion. The method was found to be generally applicable and suitable for small as well as large scale production. Transl. by K.W.

N66-28331# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
EXAMPLES OF CALCULATION OF NEUTRON DIFFUSION PARAMETERS OF A PARALLEL-PLATE LATTICE
J. D. Stewart Feb. 1966 42 p refs
(AECL-2543) CRRP-1233) CFSTI: HC $2.00/MF $0.50

Formulae are derived for the following cell-average and cell-surface diffusion parameters of a simple parallel-plate lattice: thermal-neutron parameters for thermal relaxation mode (source-free) and for mode produced by a cos Bz thermal source distribution, fast-neutron parameters for a cos Bz (discrete) distribution of fast neutron sources, and thermal-neutron parameters for thermal distribution produced by slowing-down of these fast neutrons. Author

N66-28337# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
THE USE OF AMMONIA TO SUPPRESS OXYGEN PRODUCTION AND CORROSION IN BOILING-WATER REACTORS
J. E. Le Surf, P. E. C. Bryant, and M. C. Tanner Apr. 1966 18 p refs Presented at the 22d Ann. Conf. of Natl. Assoc. of Corrosion Engr., Miami Beach, Fla., Apr. 1966
(AECL-2562) CFSTI: HC $1.00/MF $0.50

Radiolysis of the coolant in nuclear reactors cooled by boiling water results in oxygen in the steam and recirculated water phases. This has dictated the use of stainless steels as the major circuit materials for these reactors. It is shown that ammonia additions to the coolant eliminate oxygen production, permitting the use of mild steel for circuit construction with consequent sevings in capital cost. Corrosion data are presented for various out-reactor materials (carbon steel, low alloy steels, stainless steels, Monel alloy 400, Inconel alloy 600) exposed to the coolant of two phase in-reactor loops when operated neutral and with ammonia addition. The elevation in pH resulting from ammonia addition is a further advantage for low temperature parts of the circuit. Author

N66-28342# Nuklear-Chemie und Metallurgie, G.m.b.H., Wolfgang bei Hanau (West Germany).
PRODUCTION OF UO_2 POWDERS OF HIGH BULK DENSITY BY MELTING AND GRINDING AND THEIR PROCESSING INTO FUEL ELEMENTS [HERSTELLUNG VON UO_2-PULVERN HOHER SCHUETTDICHTE DURCH SCHMELZEN UND MAHLEN UND IHRE VERARBEITUNG ZU BRENNELEMENTEN] Final Report
R. Christ, W. Duerrschnabel, W. Hoppe, and L. Schikarski Brussels, EURATOM, Mar. 1966 80 p refs In GERMAN; ENGLISH summary
(Contract EURATOM-013-63-7 TEED)
(EUR-2693.d; EURAEC-1551) CFSTI: HC $3.00/MF $0.75

For the production of powders with a high particle density, suitable for vibration-compaction, further development was done on the method of melting UO_2 by induction heating under an argon blanket. Using the experimental furnace constructed and melting a total of four charges per working day, it is possible to produce up to 35 kg of melted UO_2. Melting in air or under hydrogen was found to be less favorable than melting under argon. Powder mixtures of varying grain-size distributions were made from the melted UO_2 and used for vibration-compaction tests in austenitic-steel and Zircaloy-2 cladding tubes of various sizes. The fuel densities attained were generally between 87 and 88% t.d., though in some types of tube values of up to 90% t.d. were achieved. By swaging the vibration-compacted rods it was possible to obtain fuel densities of up to 93% but the swaging can result in damage to the cladding tubes. A comparison of the production costs of powder-filled fuel rods and rods filled with sintered material showed a difference of about 6% in favor of the former. Author

N66-28352# Los Alamos Scientific Lab., N. Mex.
GAMMA DOSE RATE MEASUREMENTS—KIWI TRANSIENT NUCLEAR TEST
Fred W. Sanders 29 Mar. 1966 30 p refs
(Contract W-7405-ENG-36)
(LA-3446) CFSTI: HC $2.00/MF $0.50

Gamma-ray dose rates were measured after the destruction test of a prototype nuclear rocket reactor which was designated the Kiwi Transient Nuclear Test. Dose rates were measured around the test point out to 500 feet and in the downwind direction out to 8,000 feet. It was found that even as close as 100 feet from the test point dose rates were affected by wind direction. The passage of the effluent cloud was observed at 4,000 and 8,000 feet. Isodose rate contours were determined at several post-event times, and estimates of integrated dose to personnel making emergency entries were prepared. Author (NSA)

N66-28356# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
DEVELOPMENT OF A TEMPERATURE MONITOR FOR LARGE REACTORS
Arthur H. Dexter, Carl R. Hutter, Malcolm H. Goosey, Richard W. Leep, and John N. Wilson Mar. 1966 18 p refs
(Contract AT(07-2)-1)
(DP-834)

A temperature monitor was designed to measure the temperature rise of coolant flowing through each fuel channel of a nuclear reactor. Although the monitor was intended for use with a large heavy water-cooled reactor, the design principles are generally applicable to large power and production reactors that employ forced flow of coolant. A scanning monitor was chosen because it has more economic and operational advantages than a continuous monitor. Digital circuitry permits automatic programming, arithmetic operations, and visual displays. Arguments are presented for types of alarms which should be provided. Author (NSA)

N66-28367# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.
REACTOR FUELS AND MATERIALS DEVELOPMENT FOR FY 1965 Annual Progress Report
W. C. Francis, ed. Feb. 1966 138 p refs
(Contract AT(10-1)-205)
(IDO-17154) CFSTI: HC $4.00/MF $1.00

Progress is reported on developments in the uranium intermetallic fuel systems and on corrosion properties of several aluminum and aluminum–beryllium alloys. Microprobe examinations on irradiated and unirradiated fuel materials located fission products in fuel particles and matrix and were extremely helpful in evaluating fuel-matrix and fuel-cladding compatibility. The results of compression, impact and gas release measurements on beryllium irradiated at reactor ambient and at high temperatures are reported and compared with fractography studies. Fatigue studies on pressure vessel steels are summarized and the status is given on construction of an in-pile fatigue loop. The results are given of ultrasonic and metallographic examinations of a Fiberglas-fueled, aluminum-clad MTR fuel element. Developments in nondestructive testing, electron microscopy, fuel failure mechanisms, stress analysis, and prototypical irradiations are also reported. Author (NSA)

N66-28359# Battelle-Northwest, Richland, Wash. Reactor and Materials Technology Dept.
EXPERIMENTAL BOILING BURNOUT HEAT FLUXES WITH AN ELECTRICALLY HEATED 19-ROD BUNDLE TEST SECTION
G. M. Hesson, D. E. Fitzsimmons, and J. M. Batch Dec. 1965 47 p refs
(Contract AT(45-1)-1830)
(BNWL-206) CFSTI: HC $3.00/MF $0.50

A total of 76 boiling burnout experiments was made with an electrically heated model of a 19-rod bundle fuel element. The tests were made under a variety of conditions including two pressures, both rough and smooth wall flow housing, both subcooled and fog (wet steam) inlet coolant, and two inlet piping configurations. The experiments were made at coolant flow rates from 1,000,000 to 3,000,000 lb/hr-ft^2, and with coolant inlet conditions ranging from 300° F subcooled to 40% quality steam. Detailed results are presented. NSA

N66-28361# Battelle Memorial Inst., Columbus, Ohio.
PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING JANUARY, 1966
Donald L. Keller 1 Feb. 1966 30 p refs
(Contract W-7405-ENG-92)
(BMI-1757) CFSTI: HC $2.00/MF $0.50

Progress is reported in studies on fuels, reactor materials and components, uranium plutonium mononitride fuel materials, development of a portable smoke photometer, coated-particle fuel materials, and corrosion of the materials used in the fluidized-bed fluoride-volatility process. NSA

N66-28363# Argonne National Lab., Ill. Metallurgy Div.
ON THE THEORY OF MIGRATION AND COALESCENCE OF BUBBLES IN SOLIDS
E. E. Gruber Nov. 1965 22 p refs
(Contract W-31-109-ENG-38)
(ANL-7079) CFSTI: HC $1.00/MF $0.50

The surface-diffusion migration of an isolated pore in a solid is analyzed in detail. The results, which are similar to earlier results, are applied in analyses of bubble coalescence during postirradiation annealing. Coalescence is considered, first, as a result of random migration of bubbles, in which case the results confirm earlier results that the mean bubble radius should be proportional to $(\text{time})^{1/5}$, and second, as a result of biased migration of bubbles. In the latter case, the predicted mean radius increases linearly with time. In both cases, the bubble-size distribution is calculated and used to predict the swelling of the solid, which is about 15% greater in the first case and up to 65% greater in the second case than predicted by approximate treatments based on change in the mean bubble radius with time. Author (NSA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N66-28890# Joint Publications Research Service, Washington, D. C.
GEOMETRY AND OPTICAL CHARACTERISTICS OF A HEXAHEDRAL MIRROR-FILM MEMBRANE

G. Ya. Umarov, Yu. A. Solodyanikov, N. V. Kordub, A. A. Alimov, V. S. Zarubin et al *In its* Heliotechnology, No. 3, 1965 26 Apr. 1966 p 15–25 refs (See N66-26887 15-33) CFSTI: $3.00

A method of calculation is described for determining the geometry and optical characteristics of a hexahedral shaped facet of a mirror film membrane. The facets are to be used in the construction of a large, i.e., three to five meters in diameter, thin film plastic solar collector. It is first of all shown that a hexahedral mirror film membrane under gaseous pressure assumes a shape capable of concentrating solar rays. The shape of deflection of a thin film prestretched on a flat hexagonal frame were derived using Poisson's equation, and were found to be in complete agreement with experimental findings. The parallel rays are concentrated at the facet focus as a round spot surrounded by an aureole. An increase in concentration of one to two orders of magnitude is achieved. By the individual regulation of each facet with three screws and pressure selection, a collector may be constructed for a solar power plant capable of producing from several hundred watts to one kilowatt. D.T.

N66-26891# Joint Publications Research Service, Washington, D. C.

A STUDY OF OPTICAL AND ENERGY CHARACTERISTICS OF SOLAR RADIATION COLLECTORS FORMED BY INFLATION

B. V. Tarnizhevskiy, A. D. Razgovorov, and I. G. Savchenko *In its* Heliotechnology, No. 3, 1965 26 Apr. 1966 p 26–29 refs (See N66-26887 15-33) CFSTI: $3.00

The inflation of sheet metal by an evenly applied load, followed by stiffening with the application of epoxy resins is suggested as a technique for producing solar collectors of approximately paraboloidal or parabolic shape. In order to determine the possible applications of such collectors, their optical and energy characteristics were investigated. It was experimentally established that the maximum energy density of a paraboloidal collector 540 mm in diameter fluctuates from 4×10^5 to 6×10^5 kcal/sq m per hour. The focal images of the collectors were photographed by the light of a full moon; and it was determined that in addition to the irregular and asymmetric shape of the focal point, the collectors displayed an aureole surrounding the focal point and consisting of radially arranged bands of differeing illumination. It was also found, for a parabolocylindrical reflector 2200 mm × 550 mm, that the focal strip varied arbitrarily in its width along the whole length. Based on these and other results, it is recommended that collectors produced by the inflation technique be used in low potential thermal units. D.T.

N66-26913# Joint Publications Research Service, Washington, D. C.

INTERACTION OF SHOCK WAVE IN A PLASTIC MEDIUM WITH A DISPLACING OBSTRUCTION WITH CONSIDERATION OF INFLUENCE OF FREE SURFACE

G. M. Lyakhov, R. A. Osadchenko, and N. I. Polyakova *In its* Studies of the Phys. of Combust. and Explosion 16 May 1966 p 68–84 refs (See N66-26906 15-33) CFSTI: $3.00

The interaction of a plane compression shock wave with a barrier in elastic and plastic media (soils) was examined, with consideration given to the influence of free surface effects. In all of the examined cases, the free surface effect is manifested earlier in the plastic than in the elastic medium. In the plastic medium, the load on the obstruction remains equal to the pressure on the free surface; first there is a slight pressure drop, but this rises. In the elastic medium, the free surface effect leads to a short-lived drop in pressure to a negative value. M.W.R.

N66-26972# Joint Publications Research Service, Washington, D. C.

TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY, NO. 315

13 May 1966 26 p refs Transl. into ENGLISH from Chinese (JPRS-35498; TT-66-31934) CFSTI: $1.00

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1. PHYSICS OF THE UPPER ATMOSPHERE C.-c. Chao p 1–8 refs (See N66-26973 15-13)
2. ELECTROSTATIC ACCELERATORS M.-h. Yeh, C.-p. Ch'en, and C.-y. Chao p 9–19 refs (See N66-26974 15-23)

N66-26974# Joint Publications Research Service, Washington, D. C.

ELECTROSTATIC ACCELERATORS

Chung-yao Chao, ed. *In its* Transl. on Communist China's Sci. and Technol. 13 May 1966 p 9–19 refs Transl. into ENGLISH from the book "Ching-Tien Chia-Su-Ch'i" Peking, Sci. Press, Sep. 1965 p i–xiv (See N66-26972 15-23) CFSTI: $1.00

A brief review is given of this Chinese-language book which describes the theory, design, adjustment, and operation of the main elements of the electrostatic proton accelerator. These are identified as the electrostatic generator, the analyzer, the source of high frequency ions, the accelerator tube, the focussing system, and the vacuum system. The title page, preface, and table of contents are also presented. M.G.J.

N66-27064*# Toronto Univ., (Ontario).

REFRACTION OF SOUND BY JET FLOW OR JET TEMPERATURE

J. Atvars, L. K. Schubert, E. Grande, and H. S. Ribner Washington, NASA, May 1966 34 p refs Revised ed. of AIAA Paper-65-82

(Grants NsG-661; AD-AFOSR-223-64; AF-AFOSR-672-64; NRC A-2003)

(NASA-CR-494; AIAA Paper-65-82) CFSTI: HC $2.00/MF $0.50 CSCL 20A

The heart-shaped pattern of subsonic jet noise normally peaks somewhere between 15° and 45° from the axis, depending on conditions, falling off sharply as the axis is approached. Conflicting explanations of this directivity pattern appear in the literature. The present investigation suggests that the deep cleft in the pattern can be attributed mainly to refraction of the sound out of the jet by the velocity and temperature fields. The evidence lies in measurements made of the sound field of a harmonic "point" source placed within a 3/4 in. dia. air jet. The source is the orifice of a tube about 1/16 in. i.d. driven through a conical coupling by a horn-type loudspeaker driver; this radiates sound essentially omnidirectionally up to about 15,000 cps. The experiment established the formation of an axial intensity minimum, which appears to be mainly due to refraction. The depth of the refraction valley increases with jet velocity, jet temperature, and sound frequency; a depth corresponding to an intensity reduction of the order of 35 dB is attained at M=0.9 for 3000 cps. Author

N66-27110# California Univ., Livermore. Lawrence Radiation Lab.

FINITE DIFFERENCE METHODS FOR NONLINEAR RADIATION TRANSPORT

Philip M. Campbell 20 Aug. 1965 26 p refs

(Contract W-7405-ENG-48)

(UCRL-12411) CFSTI: HC $2.00/MF $0.50

A formulation is given of the nonlinear, frequency-dependent transport problem in one dimension, assuming local thermodynamic equilibrium. Equivalent representations of the angular distribution are discussed, including the treatment of discontinuities. A method for the combination of transport and diffusion based on the equivalence of the angular representations is presented. The performance of this method is illustrated in a variety of sample calculations.
Author (NSA)

N66-27112# Oak Ridge National Lab., Tenn.
UTILIZATION OF *A PRIORI* INFORMATION BY MEANS OF MATHEMATICAL PROGRAMMING IN THE STATISTICAL INTERPRETATION OF MEASURED DISTRIBUTIONS
W. R. Burrus (Ph.D. Thesis—Ohio State Univ.) Jun. 1965 125 p refs
(NASA- Order R-104; Contract W-7405-ENG-26)
(ORNL-3743) CFSTI: HC $4.00/MF $0.75

A statistical approach is developed for unfolding instrument measurements which are related to an unknown function by a linear integral transformation. If statistical uncertainties are present in the measured function and in the kernel of the transformation, then the use of a priori information is shown to be necessary for a nontrivial solution. Without such information, an infinite-width confidence interval can be found for any nontrivial function of the unknown function. Suitable a priori information, however, nearly always exists in physically motivated problems. The weakest form of a priori information considered is simple nonnegativity. Stronger a priori information, such as smooth or monotonic behavior, can be put in the same form as simple nonnegativity by suitable transformation. The unfolding problem requires two steps: selecting a set of functions of the unknown function to adequately describe the function and then numerically obtaining the width of the confidence interval for each function. Several computational techniques based upon linear and quadratic programming are described. Finally, the method is illustrated by unfolding gamma-ray and neutron spectra from pulse-height distributions obtained with scintillation spectrometers and by solving a poorly conditioned set of equations.
Author (NSA)

N66-27125# Rochester Univ., N. Y. Dept. of Physics and Astronomy.
ALGEBRA OF CURRENTS AND A GENERALIZED ADEMOLLO–GATTO THEOREM
G. S. Guralnik, V. S. Mathur, and L. K. Pandit 10 Dec. 1965 13 p refs Submitted for Publication
(Contract AT(30-1)-875)
(UR-875-114)

Within the framework of the W_3 symmetry, it is shown that the conservation of axial-vector current implies no renormalization, and that if the symmetry is broken in any arbitrary manner, the renormalization effects on both vector and axial-vector currents are of second order in the symmetry-breaking parameter. The results are generalized to any symmetry group for which the generators are conserved (vector or axial-vector) "charges."
Author (NSA)

N66-27140# Temple Univ. Research Inst., Philadelphia, Pa.
DENSITIES, VOLUMES, EXPANSION, COMPRESSIBILITY AND PRESSURE COEFFICIENTS AND DERIVED FUNCTIONS OF METALLIC MERCURY FOR ITS ENTIRE LIQUID RANGE, I.E. FROM ITS MELTING POINT TO ITS CRITICAL POINT
Aristid V. Grosse 3 May 1965 124 p refs
(Contract AT(30-1)-2082)
(NYO-2082-1) CFSTI: HC $4.00/MF $1.00

The volumetric behavior of mercury is described over its entire liquid range, from its melting point to its critical point, along the saturation line, as a function of temperature and pressure for both liquid and saturated vapor. Partial derivatives and the coefficients of expansion, compressibility, and pressure are given, both for liquid and saturated vapor, over the entire liquid range for the first time. Various derived properties of liquid mercury, such as kinetic pressure, $C_p - C_v$, C_p and C_v, $\beta_{(adiab.)}$, the sound velocity, and the Gruneisen constant were estimated over the entire liquid range. Numerical data of various functions are collated.
Author (NSA)

N66-27151# California Univ., Berkeley. Lawrence Radiation Lab.
A METHOD FOR DETERMINING THE GEOMETRY AND CURRENT CONFIGURATION OF A SYSTEM OF CYLINDRICALLY SYMMETRIC SOLENOID COILS FROM A SPECIFIED MAGNETIC FIELD SHAPE
Klaus Halbach and Ronald F. Holsinger *In its* Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res. [1965] p 20–26 refs (See N66-27146 15-25) CFSTI: HC $6.00/MF $1.25

Several useful computer programs have been developed which, given the geometry and current configuration of a system of coils, calculate with great speed and accuracy the properties of the magnetic field produced by the coils. Because one of our experimental programs requires a somewhat sophisticated magnetic-field shape, we have developed a method and appropriate computer programs that reverse this process. Rather than arrive at a solution for the geometry and current configuration by trial and error, the method we used systematically solves for the geometry and current configuration required to produce the desired magnetic-field shape. The coil configuration that gives the desired field shape is determined by manipulating with matrix algebra appropriate variables of all individual coils in the coil system. The variables used in our calculations are currents, relative positions, and lengths of the coils.
Author

N66-27167# California Univ., Livermore. Lawrence Radiation Lab.
MECHANICAL DESIGN AND CONSTRUCTION OF THE ALICE MIRROR AND QUADRUPOLE MAGNETS
Arthur R. Harvey *In its* Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res. [1965] p 131–137 (See N66-27146 15-25) CFSTI: HC $6.00/MF $1.25

A number of basic design and fabrication difficulties were encountered in the construction of series I and II Alice mirror magnets. A stage-by-stage photographic record was assembled during the construction of these magnets. An analysis of structural weaknesses of the coils was made from their operational history. The quadrupole magnets were then designed and constructed on the basis of conclusions derived from this analysis.
Author

N66-27168# Oak Ridge National Lab., Tenn.
SOME PROBLEMS IN THE DESIGN OF AN EIGHTH-ORDER, POWER-OPTIMIZED SOLENOID
J. N. Luton, Jr. *In* Calif. Univ. Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res. [1965] p 138–141 refs (See N66-27146 15-25) CFSTI: HC $6.00/MF $1.25

An optimization method has been applied to the design of a rectangular magnet coil for producing with minimum power a 60-kG, eighth-order field over a bore of 13 in. The required current density is a function of the distance from the midplane and varies in an irregular fashion over a range of 3 to 1. A

practical way of achieving a satisfactory approximation to the ideal current density distribution is described, along with the field shapes to be expected. Commercial tolerances on tubular conductors and winding imperfections in previously built large coils indicate that, for maximum homogeneity, the field will have to be trimmed after construction. Small current shunts will provide this trimming; the large changes possible in the shape of the B=constant surfaces are illustrated. Author

N66-27172# Aerojet-General Nucleonics, San Ramon, Calif. Research Div.
PRODUCTION OF LARGE-VOLUME MAGNETIC FIELDS BY EXPLOSIVE GENERATORS
D. B. Cummings *In* Calif. Univ. Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res. [1965] p 156–161 (See N66-27146 15-25) CFSTI: HC $6.00/MF $1.25

Explosive generators are devices in which explosive energy is converted directly into electromagnetic energy. This is done by making an explosive-driven conducting wall perform work by compressing a magnetic field. Because of the high stored energy density of explosives, these devices can be relatively small and lightweight. Heretofore it has not been worthwhile to drive large loops with an explosive generator because the loop inductance was comparable to the inductance of a helical generator, limiting the ideal gain to 10 or less. But a technique described in this paper allows coupling of one or more loops to an explosive generator which transforms the inductance of the loop(s) to an arbitrarily small value. Consequently, the lossless gain of an explosive generator driving a large loop can be made 1000 or more. With this technique magnetic fields can be produced in very large volumes limited only by the energy capability of the explosive generator. Test results are presented. Author

N66-27173# California Univ., Livermore. Lawrence Radiation Lab.
MINIMUM-B FIELD GENERATED BY "BASEBALL SEAM" CONDUCTOR
Lee C. Pittenger *In its* Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res. [1965] p 168–172 refs (See N66-27146 15-25) CFSTI: HC $6.00/MF $1.25

Computer calculations have been made of the magnetic field produced by a conductor shaped like the seam of a baseball. The resulting field has a minimum value at the origin. Mirror ratios and minimum field values are found to vary with the angle subtended by the lobes of the conductor at the origin. Injection paths for neutral particles which parallel the field lines at entry are found to give different trapping lengths and ionizing field strengths for various entry angles. A conductor approximating the baseball seam shape is being built of arcs and straight-line segments. A field and force analysis of this real magnet is made which shows that the effects of making this approximation are roughly the same as produced by lessening the lobe angle. The effect of generating the curve on an oblate or prolate spheroid is investigated also. Author

N66-27347# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
TEST OF MODELS OF A GAS DISCHARGE TRANSFORMER OF THE IMAGE [ISPYTANIE MODELEI GAZORAZRYADNOGO PREOBRAZOVATELYA IZOBRAZHENIYA]
I. I. Gromova, G. Peter, and A. F. Pisarev 3 Jul. 1965 11 p refs In RUSSIAN
(JINR-P-2256)

A possibility is considered of magnifying the light image in a gas discharge transformer. The device has two gaps: the photocathode–control grid and grid–anode. The second of them is filled with dielectric capillaries. In the first gap the photoelectrons are controlled, in the second gap the image is magnified due to a luminescence of the gas discharge. It is established that at the neon pressure of 0.6 kg/m^2 the device magnifies the image satisfactorily. Author (NSA)

N66-27372# Kernforschungsanlage, Juelich (West Germany). Zentralinstitut für Angewandte Mathematik.
AN INITIAL VALUE PROBLEM FOR THE STATIONARY BOLTZMANN–VLASOV EQUATION [UBER EIN ANFANGSWERTPROBLEM FUR DIE STATIONARE BOLTZMANN–VLASOV–GLEICHUNG]
H. Neunzert Nov. 1965 53 p refs In GERMAN
(JUL-297-MA)

The physical origin of the problem is given, and the requirements placed on functions of the equation are discussed. The principles used in the formal construction of the solution are given and are proved. The formal construction is demonstrated on the basis of an example. NSA

N66-27484# Institut für Plasmaphysik G.m.b.H., Garching (West Germany).
CALCULATION OF THE TWO-DIMENSIONAL MAGNETIC FIELD OF AN EVEN NUMBER OF IOFFE BARS BY COMPLEX ANALYSIS [BERECHNUNG DES ZWEIDIMENSIONALEN MAGNETFELDES EINER GERADEN ANZAHL VON IOFEESTAEBEN MITTELS KOMPLEXER ANALYSIS]
Rudolf Gorenflo and Helmut Welter Sep. 1965 33 p refs In GERMAN; ENGLISH summary
(IPP-6/42)

By complex representation of a plane vector field a finite expression (in elementary functions) is derived for the magnetic field produced by an even number of infinitely long Ioffe bars. This expression is valid at all points of a cross sectional plane, in the interior of the conductors as well. For numerical computation an ALGOL program is written which gives the components B_r and B_ϑ of the field at every point required. The field line plots are then obtained by using a numerical method, which is described. In addition, the behavior of quadrupole and hexapole fields in the vicinity of the axis is dealt with in detail. Author (NSA)

N66-27498*# National Aeronautics and Space Administration, Washington, D. C.
MOTION OF TWO PARTS AFTER BURSTING OF A GAS TANK IN A VACUUM [DVIZHENIYE DVUKH CHASTEY POSLE RAZRYVA OB'YEMA A GAZOM V VAKUUME]
G. L. Grodzovsky and F. A. Kukanov May 1966 15 p refs Transl. into ENGLISH from a Russian Publ., 1965
(NASA-TT-F-10135) CFSTI: HC $1.00/MF $0.50 CSCL 20D

The problem of motion in a forceless field of the two parts, formed after a gas tank bursts in a vacuum, is considered. Assuming isothermal gas expansion, the differential equation for the motion of the two gas-tank parts is similar to the Blasius' boundary layer equation. The equation of motion is also given for the adiabatic expansion, and solutions are tabulated for both equations. Author

N66-27759*# Rocketdyne, Canoga Park, Calif.
PUMP DISCHARGE OSCILLATION STUDY Quarterly Progress Report, 1 Jan.–31 Mar. 1966
E. Jackson 13 Apr. 1966 43 p refs
(Contract NAS8-20143)
(NASA-CR-75412; TAMM-6115-22) CFSTI: HC $2.00/MF $0.50 CSCL 20A

Progress on pump discharge oscillation is presented. In the acoustic wave transmission study the impedance equations of curved elbows, orifices, and straight pipes were derived which completes the study of wave transmission in elements. The test program for both the acoustic wave transmission and generation was planned and very recently initiated. The hot-wire anemometer purchased for this test program appears to be working. A computer program was written for computing the unsteady blade loading due to the passage of viscous wakes. The derivation of the conditions for wave reinforcement in pumps with a multi-vaned diffuser is presented, and a test program for confirming these analytical results is planned for the Mark 26 fuel pump in the J-2 Air Rig. Author

N66-27781# New Mexico Univ., Albuquerque. Bureau of Engineering Research.
A STUDY OF HEAT-GENERATED PRESSURE OSCILLATIONS IN A CLOSED END PIPE
Karl Thomas Feldman, Jr. (Ph.D. Thesis—Missouri Univ.) Jan. 1966 219 p refs Sponsored in part by Sandia Corp.
(Contract AT(29-1)-789)
(SC-DC-66-1293; ME-18) CFSTI: HC $6.00/MF $1.25

The phenomena investigated is the heat generated pressure oscillation known as the Sondhauss thermoacoustic oscillation. Sondhauss oscillations occur when heat is added steadily to the gas in a pipe having one closed end. The available published reference on the Sondhauss oscillation and a related thermoacoustic phenomenon known as the Rijke oscillation are listed and reviewed. A physical analysis of the heat exchange mechanism driving the Sondhauss oscillation is presented. The Sondhauss oscillator is treated as a heat engine operating on a specified thermodynamic engine cycle. The factors which initiate and maintain thermoacoustic oscillations are analyzed. The fundamental driving mechanism is shown to be a combination of simple thermal expansion and a mixing expansion resulting from the difference of molar specific heats of the hot and cold gas which is mixed during the cycle. A mathematical model for the Sondhauss oscillation is also presented. An experimental study of the Sondhauss oscillation is presented where sound pressure level and frequency distribution were measured for variations in pipe length, probe position along the pipe, heater power, heater position, tube bundle position, tube-bundle tube diameter and length and operating gas. The experimental results are presented in dimensional and dimensionless form. A theoretical model of the Sondhauss oscillator is derived from the fundamental hydrodynamic equations and from the heat engine analogy. The solution of the theoretical model was obtained by an analog computer using a finite difference approximation. By scaling the results of the analog computer solution to coincide with the experimental results, the characteristics of the heat addition term were analyzed. The results of the theoretical analog solution were the same as the experimental results to within 5% for both sound pressure magnitude and frequency. The heat engine aspects of the Sondhauss oscillator hypothesized in the physical analysis were verified by the experimental results and the analog computer results. NSA

N66-27807# Hebrew Univ., Jerusalem (Israel). Dept. of Physics.
ELECTRON DENSITY AND IONIZATION PHENOMENA IN SHOCK WAVES Annual Summary Report
W. Low 23 Nov. 1965 21 p refs
(Contract AF 61(052)-846)
(AFOSR-66-0634; AD-631006) CFSTI: HC $2.60/MF $0.50

A new shock-tube suitable for microwave and optical measurements was designed and manufactured. It was established that the Mach speed behind a taper section ending in an area change is close to that predicted by the steady state theory provided measurements are made far enough downstreams, and provided viscous corrections are being made. However, near the transition section, large deviations from the values predicted either by the steady state or linear theory are found. Within 20–50 nozzle lengths there are fluctuations in the Mach speed which are only damped out far enough downstreams. For the inverse problem of a shock flow into an expanding constriction yielding a larger area, one also finds that the Mach speed far enough downstreams approximates the steady state theory. However, near the transition section the fluctuations are not as violent. The optical data show a peculiar intensity dependence on the position behind the shock front. TAB

N66-27814# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
OPTICAL PROPERTIES OF MERCURY SULFIDE
B. F. Bilen'kii, M. V. Pashkovskii, A. E. Nosenko, and Z. G. Grechukh 7 Mar. 1966 9 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 8, no. 8, 1963 p 913–915)
(Contract NOw-62-0604-c)
(TG-230-T463; AD-630824) CFSTI: HC $1.00/MF $0.50

An arrangement for studying the optical properties of microcrystals is described. The absorption and reflection spectra of synthetic mercury sulfide crystals were obtained in the characteristic absorption region. The absorption edge of α–HgS free of impurities was observed at 610 mμ. A 575-mμ band was detected in the absorption spectrum and a 600-μ band in the reflection spectrum. A photograph was taken of the diffuse reflection spectrum of powdered mercury sulfide samples obtained by grinding single crystals. The width of the forbidden zone of α–HgS was determined from the diffuse reflection spectrum and is 2.10 ev. A study was made of the influence of iodine and copper impurities, in various concentrations, on the diffuse reflection spectrum of mercury sulfide. Author (TAB)

N66-27830# Naval School of Aviation Medicine, Pensacola, Fla.
THE INTERPRETATION OF AUDIOMETRIC FINDINGS WITHIN A HEARING CONSERVATION PROGRAM
Vernon C. Bragg 20 Dec. 1965 15 p *lts* Spec. Rept.-65-8
(AD-630999) CFSTI: HC $1.60/MF $0.50

A method for interpretation of audiometric data obtained within the Navy's Hearing Conservation Program is presented. An explanation of the various audiometric contours is given, followed by a step-by-step procedure for analyzing the pure tone audiogram. In addition, recommendations are made concerning the disposition of patients whose audiograms do not fall within normal limits. Utilization of these procedures within a comprehensive program of hearing testing, noise control, and education is recommended for all ships and stations whose personnel work in hazardous noise. Author (TAB)

N66-27917# Los Alamos Scientific Lab., N. Mex.
CRYOGENIC EVALUATION LABORATORY TEST OF A (MASONEILAN) CRYOGENIC LOW PRESSURE COUPLING
D. H. Liebenberg 2 Jan. 1966 9 p refs
(Contract W-7405-ENG-36)
(LA-3454) CFSTI: HC $1.00/MF $0.50

The results of the leakage testing of a Masoneilan transfer line coupling are presented. The cooldown tests of the 8-in.-diameter coupling were carried out with the coupling

installed in an 8-in.-diameter transfer line and were performed with flow rates of 6 lb/sec of liquid hydrogen. A pressure test of this coupling, rated at 150 psig, was made at 95 psig. Leakage was observed to be at the limit of observational error. Author (NSA)

N66-27935*# Kansas Univ., Lawrence. Center for Research in Engineering Science.

EXACT SOLUTION TO THE SCATTERING OF WAVES FROM A ROUGH SURFACE

A. K. Fung [1964] 15 p refs

(Grants NsG-298; NSF GP-2259)

(NASA-CR-75616; CRE-481) CFSTI: HC $1.00/MF $0.50 CSCL 20F

An exact solution is obtained for the scattering of an arbitrary scalar wave from a rough surface in terms of a series of functions by means of a complete set of functions orthogonal over the illuminated area. The method used, that of undetermined coefficients, is adapted to the solution of either the Neumann or the Dirichlet problem. Author

N66-27936*# Kansas Univ., Lawrence. Center for Research in Engineering Science.

OMNIDIRECTIONAL SCATTERING OF ULTRASONIC WAVES FROM ROUGH SURFACES OF KNOWN STATISTICS WITH APPLICATION TO ELECTROMAGNETIC SCATTERING

R. K. Moore and B. E. Parkins [1963] 15 p refs

(Grants NsG-298; NSF GP-2259)

(NASA-CR-75617; CRES-48-2) CFSTI: HC $1.00/MF $0.50 CSCL 20N

The results of an investigation of the directional properties of waves scattered from rough surfaces are presented. The bi-static scattering of ultrasonic waves has been measured for planar surfaces of different known roughness, and the average differential scattering cross section computed. The value of the acoustic measurements is considered from the viewpoint of validation of electromagnetic theories of scattering. Author

N66-28018*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A REVIEW OF BALL MOTION IN AN ANGULAR CONTACT BALL BEARING

R. J. Parker, E. V. Zaretsky, and W. J. Anderson Washington, NASA, 1966 37 p refs Presented at the Am. Soc. of Mech. Engr. Spring Lubrication Symp., New Orleans, 6 Jun. 1966

(NASA-TM-X-52207) CFSTI: HC $2.00/MF $0.50 CSCL 13I

A significant portion of total ball-bearing friction results from friction due to sliding or spinning in the contacts of the balls and races. A brief review of the nature of this ball-race contact including analyses of ball spin and microslip and the factors contributing to the problem are presented in this paper. Author

N66-28035*# Virginia Univ., Charlottesville.

KINEMATIC TRANSFORMATIONS OF SEVERAL MECHANISMS

David W. Lewis Washington, NASA, Jun. 1966 257 p

(Grant NsG-682)

(NASA-CR-512) CFSTI: HC $6.00/MF $1.50 CSCL 20

This work presents a selection of kinematic information, on several different mechanisms, in graphical form. Hopefully, this will provide the means for "getting a feeling" for these several mechanisms and aid in the selection of a mechanism to obtain a specific input-output motion transformation. The considerable range in form of the motion transformations presented here indicate an almost unlimited scope of possible transformations. It is expected that this information will afford the design engineer a means for solving many kinematic problems by selecting the appropriate mechanism directly from this compilation. In addition, minor changes to the parameters (link lengths or gear diameters), which determine the motion transformation of a particular mechanism, may produce more exact solutions to specific kinematic problems. Author

N66-28100# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).

INFRARED—AN ANNOTATED BIBLIOGRAPHY UP TO 1966

H. Lieffering, comp. Mar. 1966 167 p refs In ENGLISH, DUTCH, FRENCH and GERMAN

(TDCK-44741) CFSTI: HC $5.00/MF $1.00

This paper contains abstracts of infrared studies: general, emission, transmission, detection, noise, systems, applications, miscellaneous, and bibliographies. Within each chapter the material has been arranged chronologically; an author index is provided. Author

N66-28104# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.

THE LABORATORIES OF PHYSICS AT THE BEGINNING OF 1966 [I LABORATORI DI FISICA, ALL'INIZIO DEL 1966]

M. Ageno 15 Feb. 1966 35 p

(ISS-66/3) CFSTI: HC $2.00/MF $0.50

Research activities in high energy and nuclear physics, X-ray physics and radiation dosimetry, organic molecular structure, biophysics, electron microscopy, theoretical physics, and other related efforts, are discussed. Studied were: (1) the binding energy of protons bound in the deeper energy levels of the nucleus, (2) the scattering of X-rays by electrons bound to the K and L atomic levels (and the fluorescent yield of the various levels), (3) instrumental analyses (NMR, X-ray diffraction, mass spectrography, and microwave system) of organic molecules and related bonds, (4) the formation of complexes at room temperature between the biologically active strand of denatured DNA and a fraction of ribosomal RNA, (5) the mechanism of action of ionizing radiations on genetic material, (6) the physico-chemical properties of DNA, (7) the use of electron microscopy for histological, morphological, cytochemical, bacterial, viral, and organic molecular investigations, (8) elementary particle classification, (9) phase transitions between normal and superfluid systems, (10) low energy nuclear interactions and other work activities of the Laboratory. Basic problems regarding the functioning of the Laboratory and personnel training are also discussed. L.S.

N66-28135# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati.

CALCULATION OF THE INTERNAL SCREENS IN THE TARGETS OF THE FRASCATI LINEAR ACCELERATOR [CALCOLO DELLE SCHERMATURE INTORNO ALLE TARGHETTE DELL'ACCELERATORE LINEARE DI FRASCATI]

M. Pelliccioni 8 Mar. 1966 17 p refs In ITALIAN /ts Nota Interna No. 313

(LNF-66/14) CFSTI: HC $1.00/MF $0.50

Radiation absorption was measured at two points of the linear accelerator. The radiation beam dosage was calculated numerically in the region of the tungsten target; at this point the electrons collided with energy in the range of 90 MeV. A

second calculation was made at the collimator on the end of the linear accelerator, and the electron collision was found to be 400 MeV. A table shows the energy spectrum of the neutrons generated in the target, and the mean free path of the neutron particles, as a function of energy, was studied experimentally and expressed as an equation. Graphs show the air density and the thickness of the concrete shielding screen used in relation to the radiation dosage. Experimental results indicate that no reinforcement of the lateral concrete screen was necessary for the maximum permissible level of radiation generated in the converter. A 6 m concrete screen placed between the target itself and the area occupied by research workers reduced the radiation dose to acceptable levels.

Transl. by R.Ll.

N66-28229# Weapons Research Establishment, Salisbury (Australia).

A MATHEMATICAL MODEL DESCRIBING THE DETECTION OF DISTANT OBJECTS

D. J. Gambling Feb. 1966 79 p refs

(WRE-TN-ISD-68) CFSTI: HC $3.00/MF $0.75

A theoretical model is formulated which describes the visibility of distant objects with respect to photographic systems. The various factors which influence visibility are considered in order to predict the limiting detectable range of a given object under various operating conditions. A comparison of theoretical and experimental results shows that over most sightlines there is agreement within the experimental error. However, the experimental results are at variance with those of the model at elevations below 12°. Causes for the discrepancy are suggested. Author

N66-28232# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.

THE SEMINAR AT THE PHYSICS LABORATORY DURING THE PERIOD SEPTEMBER–DECEMBER 1965 [IL SEMINARIO DEI LABORATORI DI FISICA NEL QUADRIMESTRE SETTEMBRE–DICEMBRE 1965]

30 Dec. 1965 50 p In ITALIAN and ENGLISH

(ISS-65/50) CFSTI: HC $3.00/MF $0.50

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N66-28239# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.

AN ELECTRON MICROSCOPE STUDY OF OSTEON CALCIFICATION

A. Ascenzi, E. Bonucci (Pisa Univ.), D. Steve Bocciarelli 5 Oct. 1965 23 p refs Sponsored by the Consiglio Nazl. Delle Ric.

(ISS-65/37) CFSTI: HC $1.00/MF $0.50

The dynamics of osteon (Haversian system) calcification was investigated under the electron microscope and shown that, after a sudden initial penetration of a large percentage of the matrix by elongated needle-shaped crystallites, the apatite is laid down slowly, starting from the board bands at the major collagen periods. Author

N66-28269# David Taylor Model Basin, Washington, D. C.

SOME NUMERICAL CALCULATIONS OF SOUND RADIATION FROM VIBRATING SURFACES Final Report

George Chertock and Marie A. Grosso Mar. 1966 21 p refs

(DTMB-2109; AD-631300) CFSTI: HC $1.00/MF $0.50

Three particular problems in sound radiation from vibrating surfaces are solved by a method which is based on the numerical solution of the Helmholtz integral equation for the sound pressure at the vibrating surface. Numerical results are given for the near and far field of (1) a circular piston vibrating on the surface of a sphere, (2) the radial pulsations of a finite cylinder, and (3) a narrow zonal piston vibrating on a spheroid. In all cases, the results are considered more accurate than previous values reported in recent literature.

Author (TAB)

N66-28311# Naval Postgraduate School, Monterey, Calif.

AN INVESTIGATION OF THE VERTICAL VARIATION OF LIGHT SCATTERING IN MONTEREY BAY, CALIFORNIA

Charles H. Bassett, Jr. and Harry C. Furminger (M.S. Thesis) 1965 97 p refs

(AD-616778) CFSTI: HC $3.00/MF $0.75

An investigation of the vertical variations of the scattering coefficients for visible light at a selected location in Monterey Bay, California, was conducted during December, 1964, January and February, 1965. Forty-six water samples were collected at various depths on five separate sampling days. Where possible, concurrent light attenuation (horizontal) and solar light extinction measurements were made in situ. The water samples collected were analyzed for density and inorganic phosphates. From the scattering coefficients computed, and hand-fitting of scattering function curves with theoretical curves, the particle size and particle concentration was estimated for each sample. The relationships between the sea water density, phosphate content, and the empirically derived scattering coefficient, particle size, and particle concentration were examined. The only significant correlation found is that between particle size and particle concentration. A particle concentration maximum was observed above and adjacent to the pycnocline where one existed. Author (TAB)

N66-28317# Uppsala Univ. (Sweden). Quantum Chemistry Group
BIPOLAR EXPANSION OF SCREENED COULOMB POTENTIALS, HELMHOLTZ' SOLID HARMONICS, AND THEIR ADDITION THEOREMS Scientific Report No. 53
Reikichi Nozawa Wright-Patterson AFB, Ohio, ARL, 1 Nov. 59 p refs *Its* Preprint No. 159
(Contract AF 61(052)-701)
(ARL-66-0076; AD-631292) CFSTI: HC $5.60/MF $0.75

Helmholtz' solid harmonics (spherical Bessel functions X spherical surface harmonics) are generated from fundamental spherical waves through a ladder procedure using raising and lowering operators. The addition theorem for them and the bipolar expansion formula of a screened Coulomb potential are derived. A method for evaluating two-center integrals with a general potential is given which is new and useful in practical calculations. Lastly, a key function, which appears in all the essential results, is studied in detail.
Author (TAB)

N66-28325# Air Force Cambridge Research Labs., Bedford, Mass. Microwave Physics Lab.
SOURCE-FIELD CAUSALITY AND ITS APPLICATION TO CLASSICAL RADIATION THEORY Interim Scientific Report
Evert J. Post Feb. 1966 29 p refs *Its* Phys. and Math. Sci. Res. Paper No. 201
(AFCRL-66-146; AD-631275) CFSTI: HC $2.60/MF $0.50

A mathematical procedure is given for singling out the causal solutions from the general set of solutions of self-adjoint differential equations. It consists in splitting the self-adjoint equation into a pair of adjoint equations whose solutions are purely causal and purely anti-causal, respectively. A subsequent merging of the equations then generates in full detail, including singularities, the causal and anti-causal solutions of the original self-adjoint equation. As an important example, it is shown that the d'Alembertian with point source has a legitimate causal solution involving both retarded and advanced potentials at the source point itself, while at all other points, the retarded potential alone satisfies causality. Within the context of the formalism some recent attempts at modifying classical radiation theory can now be reassessed and more clearly categorized. In particular, the Dirac and Wheeler–Feynman approaches are examined in this light.
Author (TAB)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N66-27066*# California Inst. of Tech., Pasadena.
NEUTRON STARS II. NEUTRINO-COOLING AND OBSERVABILITY
John N. Bahcall and Richard A. Wolf [1965] 61 p refs Submitted for Publication
(Grant NGR-05-002-028; Contract Nonr-220(47))
(NASA-CR-67875) CFSTI: HC $3.00/MF $0.75 CSCL 20H

Calculations of the rates of the cooling reactions $n+n \rightarrow n+p+e^{-}+\bar{\nu}_e$ and $\pi^{-} \rightarrow n+e^{-}+\nu_e$ are presented; the rates of the closely related muon-producing reactions and the four inverse processes are also given. Several different arguments are used to obtain estimates of the relevant matrix elements. The nucleons are assumed to form a normal Fermi fluid with a continuous excitation spectrum. The calculated cooling rates indicate that a neutron star containing quasi-free pions would cool within a few days to a temperature so low that the star would be unobservable. The surface of a star that does not contain quasi-free pions would cool to 10^{7}° K in a few months and would reach 4×10^{8}° K in about 100 years. The calculated cooling rates strongly indicate that the discrete X-ray sources located in the direction of the galactic center are not neutron stars.
Author

N66-27067*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A NUMERICAL SIMPLIFICATION AND ALTERNATIVE TO THE RKR METHOD FOR DIATOMIC MOLECULES
W. E. Meador [1965] 17 p refs Submitted for Publication
(NASA-TM-X-56898) CFSTI: HC $1.00/MF $0.50 CSCL 20H

A new transformation of the Klein integrands is introduced so as to avoid the unnecessary inconvenience of having the integration variable different from that provided by experiment. As an alternative to the Rydberg–Klein–Rees equations, the simplification of Singh and Jain is extended to eliminate all reference to rotation and Klein's troublesome g function; not only do numerical integrations disappear, but WKB results are reduced to their bare essentials. Application of this extension to the fourteenth vibrational level of normal molecular hydrogen, which energy corresponds to 98% of the way toward dissociation, reveals an error of only 0.41% in the maximum turning point.
Author

N66-27068# Los Alamos Scientific Lab., N. Mex.
MEDIUM-ENERGY PHYSICS PROGRAM Quarterly Status Report, 1 Oct 1965–31 Jan. 1966
4 Mar. 1966 86 p
(Contract W-7405-ENG-36)
(LA-3479-MS) CFSTI: HC $3.00/MF $0.75

Engineering, fabrication, and testing of 805-Mc waveguide structures were continued. Forty cells of a $\beta=0.708$ (390-Mev protons) cloverleaf cavity system were fabricated and successfully brazed to form a single vacuum-tight tank. Various aspects in the development of r-f power systems are reported. Further development of accelerator control and instrumentation systems is reported. In addition, beam motion, shielding, and activation calculations were made in conjunction with linear accelerators.
NSA

N66-27098# Oak Ridge National Lab., Tenn. Atomic and Molecular Process Center.
BIBLIOGRAPHY OF ATOMIC AND MOLECULAR PROCESSES FOR 1964
C. F. Barnett, D. A. Griffin, M. O. Krause, J. R. Ray, J. W. Hooper, comp. (Georgia Inst. of Tech.) Feb. 1966 233 p refs Prepared in cooperation with Georgia Inst. of Tech.
(Contract W-7405-ENG-26)
(ORNL-AMPIC-3) Available from Oak Ridge Natl. Lab.

The bibliography contains references of interest to atomic and molecular processes research. Bibliographic sources consisted of fifty-two scientific journals and four abstract journals. The references are classified into fourteen categories and the references in each category are listed alphabetically by author.
Author (NSA)

N66-27113# Oak Ridge National Lab., Tenn.
SPECTRA OF GAMMA RAYS PRODUCED BY THE INTERACTION 160-MEV PROTONS WITH BE, C, O, AL, CO, AND BI
W. Zobel, F. C. Maienschein, and R. J. Scroggs Apr. 1965 81 p refs
(NASA Order R-104; Contract W-7405-Eng-26)
(ORNL-3506) CFSTI: HC $3.00/MF $0.75

A measurement of the gamma rays in the energy range from 0.6 to 11 Mev resulting from bombardment of Be, C, H_2O, Al, Co, and Bi targets with 160-Mev protons has been completed. A three-crystal scintillation spectrometer was used as a pair spectrometer for photons having energies above 2 Mev and as a total-absorption, anticoincidence spectrometer for photons having energies below 2.5 Mev. A time-of-flight method was used to reject neutrons, with an average rejection efficiency of 0.70±0.01. Data were obtained in the form of pulse-height spectra, which were converted to photon spectra by a computer-programmed "unscrambling" technique, resulting in the assignment of upper and lower spectral bounds representing a 68% confidence interval. The bulk of the data was obtained at 136° from the direction of the proton beam; other data obtained with aluminum targets at 44 and 20.5° gave no evidence of anisotropy. Discrete gamma rays were found for all materials except bismuth. Cross sections for the production of these gamma rays were computed and plausible assignments were made for the transitions giving rise to these lines. In the case of Al, Co, and Bi a continuum was observed, underlying the discrete spectrum for the aluminum and cobalt targets. The total gamma-ray production cross sections for photons in the energy range from 0.6 to 11 Mev were calculated to be: Be, (6.8±1.3) mb; C, (41.4±6.3) mb; O, (115±22) mb; Al, (434±97) mb; and Co, (1050±220) mb. Author (NSA)

N66-27121# Stanford Univ., Calif. Linear Accelerator Center.
STORAGE RING SUMMER STUDY, 1965, ON INSTABILITIES IN STORED PARTICLE BEAMS A Summary Report
B. Richter, M. Sands, and A. M. Sessler, ed. Aug. 1965 84 p refs
(Contract AT(04-3)-515)
(SLAC-49) CFSTI: HC $3.00/MF $0.75

Eleven papers are included; separate abstracts have been prepared for 8. The remaining 3 very short papers are concerned with media effects on beams in straight circular pipes, longitudinal resistive instabilities of azimuthally bunched beams, and one-dimensional calculations of particle trajectories in colliding beam. The electromagnetic fields of longitudinally bunched charged-particle beams moving in straight circular pipes of finite conductivity are studied, for the case in which the distance between bunches is large compared with the pipe diameter. The effects of pipe thickness are studied. Asymptotic field limits are approximated for various geometries. The electromagnetic fields of a bunched charged-particle beam that is oscillating transversely in a rectangular duct whose walls have finite conductivity are studied by asymptotic synthesis for the Fourier components. The method is first used to find the (continuous) components of the perturbation fields, and these components are then used to approximate the "wake" fields. The "wake" electromagnetic fields produced in circular vacuum chambers by the passage of charged-particle bunches are calculated by application of the Maxwell equations to the wall currents induced by these fields. Both the longitudinal and transverse wake fields are calculated. Finite electric conductivity of the chamber walls is assumed. Transverse coherent instabilities in bunched charged-particle beams traveling in circles inside toroidal vacuum chambers are studied. A computer program is discussed that solves the normal-mode instability problems for an ultrarelativistic charged-particle beam consisting of bunches. The effects of dielectric coatings on the electromagnetic fields of an intense coasting beam in a cylindrical pipe are studied. The effects of filling the entire pipe volume with a homogeneous dielectric medium are also studied. The perturbation fields produced by the presence of the dielectrics are formulated. A general theory is developed to described the coherent motion of bunches of particles in electron-positron storage rings. The bunches are taken to be internally rigid, and to interact with each other through direct fields as well as through fields associated with resistive vacuum tank walls; thus each bunch is affected by its own local fields (including images), its own wake field as encountered on subsequent traversals, the wave fields of other bunches in the same beam, and by the bunches of the other beam through direct fields encountered at crossing as well as wake fields. It is assumed that the storage ring is so designed and operated that each bunch of one beam encounters all bunches of the other beam; in fact, one bunch collides with a given bunch of the other beam twice per revolution. A discussion is presented of incoherent proton-beam instabilities in cases of interest in the operation of the CERN intersecting storage rings. Theoretical predictions are compared with experimental results. NSA

N66-27130# Brookhaven National Lab., Upton, N. Y.
ACCELERATORS OF THE FUTURE
John P. Blewett Sep. 1965 15 p
(Contract AT(30-2)-GEN-16)
(BNL-741(T-269), Rev.) CFSTI: HC $1.00/MF $0.50

The future development of accelerators is discussed in terms of high intensity, colliding beams, and super-high energies. NSA

N66-27139# Gt. Brit. National Inst. for Research in Nuclear Science, Chilton. Rutherford High Energy Lab.
THE JOKING SYSTEM: JOINT KINEMATICAL AND GEOMETRICAL ANALYSIS OF BUBBLE CHAMBER EVENTS
E. C. Sedman Aug. 1965 42 p refs
(RHEL/R-111)

The special features of the JOKING system for the analysis (geometry and kinematics) of bubble chamber events are described. NSA

N66-27142# Notre Dame Univ., Ind.
[REACTION CROSS SECTIONS] Final Report,
Richard C. Pilger Jan. 1966 58 p ref
(Contract AT(11-1)-834)
(TID-22637) CFSTI: HC $3.00/MF $0.75

The excitation functions and cross sections were calculated for the following reactions; $^{165}Ho(\alpha,3n)^{168}Tm$, $^{165}Ho(\alpha,4n)^{165}Tm$, $^{165}Ho(\alpha,2n)^{167}Tm$, $^{165}Ho(\alpha,n)^{168}Tm$, $^{164}Er(\alpha,2n)^{166}Yb$, $^{168}Er(\alpha,4n)^{168}Yb$, $^{164}Er(\alpha,3n)^{165}Yb$, $^{164}Er(\alpha,n)^{167}Yb$, $^{168}Er(\alpha,3n)^{167}Yb$, $^{167}Er(\alpha,4n)^{167}Yb$, $^{168}Er(\alpha,pn)^{168}Tm$, and $^{169}Er(\alpha,p2n)^{168}Tm$. The results are presented. NSA

N66-27249# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.
MEASUREMENT OF THE ABSOLUTE VALUE OF ETA FOR U-233, U-235 AND PU-239 USING MONOCHROMATIC NEUTRONS

J. R. Smith, S. D. Reeder, and R. G. Fluharty Feb. 1968 51 p refs
(Contract AT(10-1)-205)
(IDO-17083) CFSTI: HC $3.00/MF $0.50

The absolute value of eta, the number of fission neutrons per absorption, was measured for ^{233}U, ^{235}U, and ^{239}Pu, using monochromatic neutrons from the crystal spectrometer at the Materials Testing Reactor. Measurements were made on all three isotopes at 0.025-eV neutron energy, and on ^{233}U and ^{239}Pu at 0.057 ev. The Bragg beam from Be (0002) was passed through a mechanical monochromator to remove higher-order neutrons and yield a truly monochromatic beam. The neutron detector was a manganous sulphate bath, which absorbed in turn the Bragg beam and then the fission neutrons produced when the beam was completely absorbed in a fissionable sample. The ratio of the levels of ^{56}Mn activities produced in the two types of irradiation yielded the value of eta for the fissionable material of the sample, after the application of a few small corrections. The method of least squares was used to extract the values of eta from the experimental data. Author (NSA)

N68-27280# Mound Lab., Miamisburg, Ohio.
DETERMINATION OF COINCIDENCE CORRECTIONS IN A PROPORTIONAL COUNTER III. LEAST SQUARES ANALYSIS BY THE VARIATIONAL AND GENERAL METHODS
H. W. Kirby and J. Z. Braun 28 Jan. 1968 31 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1263) CFSTI: HC $2.00/MF $0.50

The half life of a short-lived radioisotope and the resolution time of a counting system can be simultaneously determined by either of two adaptations of the method of least squares. In the variational method, the equations are first linearized by assuming exact values for either of the two constants sought and then finding the pair of values which minimize the sums of the squares of the weighted residuals. In the general method, standard techniques are applied to determining the three constants of a non-linear equation. Both methods yield the same results. It is found that both the variational and the general methods yield more realistic estimates of the uncertainties in the half life and the resolution time than do the customary methods of computation. The FORTRAN programs used in making these computations are included. Author (NSA)

N68-27326# California Univ., Berkeley. Lawrence Radiation Lab.
K^--PROTON ELASTIC SCATTERING IN THE MOMENTUM RANGE 700 TO 1400 MeV/c
William R. Holley 22 Oct. 1965 97 p refs
(Contract W-7405-ENG-48)
(UCRL-16274) CFSTI: HC $3.00/MF $0.75

Differential cross sections for elastic K^--p scattering were measured at incident-kaon momenta from 700 to 1400 MeV/c. A total of 17,000 elastic events were observed with narrow-gap cylindrical and parallel-plate spark chambers. Least-squares fits of Legendre-polynomial power series to the differential cross sections require fifth-order terms in the region of the suggested 1765- and 1815-MeV resonances. Sixth-order coefficients are not required. The behavior of the coefficients requires a highly elastic resonance of an additional enhancement near 1765 MeV. The latter resonance, if it exists, is rather inelastic. Least-squares fits of one or more Breit-Wigner resonance terms with constant backgrounds to the total elastic and total cross sections and a qualitative analysis of the Legendre-polynomial coefficients favor a $J=5/2$ assignment for the 1815-MeV resonance, although $J=3/2$ cannot be completely excluded. Author (NSA)

N68-27327# Oak Ridge National Lab., Tenn.
NUCLEAR STRUCTURE STUDIES IN ZIRCONIUM WITH 65-MEV ALPHA PARTICLES
Carrol R. Bingham (Ph.D. Thesis—Tenn. Univ.) Jan. 1968 132 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1336) CFSTI: HC $4.00/MF $1.00

Optical-model analysis of elastic scattering from ^{92}Zr yielded a distinct minimum in χ^2 at a real well depth of 34.6 MeV. A continuous ambiguity was found indicating the importance of the surface region of the potential. Collective-model calculations for the inelastic scattering showed no preference among the ambiguous potentials, and predictions were generally in good agreement with the data. Shell model and distorted wave calculations were also made. The ^{92}Zr (α,He-3) angular distribution showed sensitivity to the choice of optical-model parameters. NSA

N68-27329# Oak Ridge National Lab., Tenn. Physics Div.
NUCLEAR GROUND STATE PROPERTIES OF ^{16}O BY AN EXTENSION OF THE EDEN–EMERY METHOD
Alan Douglas Mac Kellar Feb. 1968 149 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1374) CFSTI: HC $4.00/MF $1.00

A Brueckner theory calculation of the nuclear ground state properties of ^{16}O is performed. The method employed is an extension of the calculations of Eden and Emergy, and Eden, Emery, and Sampanthar. The Bethe–Goldstone equation is solved using harmonic oscillator unperturbed single particle wave functions and the Eden–Emery approximation of the effect of the exclusion principle. Explicit equations are derived for the Brueckner–Hartree–Fock single particle potential and ground state binding energy for doubly closed-shell nuclei using the transformation properties of harmonic oscillator functions from single particle to relative and center-of-mass coordinates. However, in the numerical calculation for ^{16}O, the Eden–Emery–Sampanthar approximation to self consistency is kept, which adds an adjustable state-dependent constant to the harmonic oscillator potential and employs an approximate variational calculation to determine the harmonic oscillator range parameter. The two-nucleon interactions studied are the standard hard core potential of Moszkowski and Scott (SHC), the Brueckner–Gammel–Thaler potential (BGT), the Hamada–Johnston potential (HF), and the Yale potential. The resulting calculated binding energy per nucleon for ^{16}O is −5.1 MeV for SHC, −9.2 MeV for BGT, −8.0 MeV for HJ, and −5.1 MeV for Yale. Single particle levels are calculated and in general are more tightly bound than the levels calculated by Brueckner, Lockett, and Rotenberg applying the "local density" approximation to nuclear matter t-matrix elements. The calculated $P_{1/2}$–$P_{3/2}$ splitting is found to be larger and the model rms radius smaller than the experimental values for all cases. NSA

N68-27330# Oak Ridge National Lab., Tenn.
EXCITATION AND DISINTEGRATION OF NUCLEI BY LOW-ENERGY ELECTRONS AND X-RAYS
E. Guth and R. D. Edge (South Caroline Univ.) [1968] 8 p refs
Presented at Am. Phys. Soc. Meeting, Gatlinburg, Tenn.
(Contract W-7405-ENG-26)
(ORNL-P-1927; CONF-681118-5) CFSTI: HC $1.00/MF $0.50

The purposes and uses of low energy (E<30 MeV) electron studies are briefly discussed. Examples are given of ^7Li and ^{115}In excitation by low energy electrons and X-rays for energy level determinations. NSA

N66-27338# California Univ., Berkeley. Lawrence Radiation Lab.

PION-PROTON CHARGE-EXCHANGE SCATTERING, 500 TO 1300 MeV

Charles Bin Chiu (Ph.D. Thesis) 2 Nov. 1965 162 p refs
(Contract W-7405-ENG-48)
(UCRL-16209) CFSTI: HC $5.00/MF $1.00

Differential cross sections for the reaction $\pi^- p \rightarrow \pi^0 n$ were measured at nine incident-pion kinetic energies in the interval from 500 to 1300 MeV. The negative pion beam, obtained from the bevatron, was focused on a liquid hydrogen target surrounded by a cubic array of six steel-plate spark chambers. The spark chambers were triggered on events with neutral final states. Charge-exchange events were identified from the one-shower and two-shower events in the spark chamber pictures. By the Monte Carlo technique, the π^0 distributions were calculated from the bisector distributions of the two-shower π^0 events together with the observed gamma-ray distributions of the one-shower π^0 distributions were fitted with both Legendre polynomial expansions and power-series expansions by the method of least squares. The extrapolated forward differential cross sections are in good agreement with the dispersion calculations. The Legendre coefficients for the differential cross sections in a pure $I=1/2$ isospin state, and for the differential cross sections due to the interference of $I=3/2$ and $I=1/2$ amplitudes, were obtained by combining our results with the available data on $\pi^+ p$ elastic scattering, in the light of the existing phase-shift solutions, the behavior of these coefficients is discussed. The well-known D_5F_5 interference term that peaks near 900 MeV is verified to be predominantly in a pure $I=1/2$ state. Author (NSA)

N66-27339# California Univ., Berkeley. Lawrence Radiation Lab.

NEW OUTLOOKS IN STRONG INTERACTION PHYSICS

Richard D. Slansky 18 Oct. 1965 48 p refs
(Contract W-7405-ENG-26)
(UCRL-16530) CFSTI: HC $2.00/MF $0.50

A typical experiment is described with quantities such as cross sections and branching ratios. The S-matrix is then defined according to quantum mechanics. Relativistic kimematics is also given. From the kinematics and the description of the scattering processes, it is shown how short-lived particles (10^{-24} sec) can be detected. The dynamics of strongly interaction particle processes is treated, and results of quantum mechanics and field theory are used to motivate S-matrix theory. The principle of maximal analyticity is explained. This together with the concept of crossing makes the basis of the bootstrap theory plausible. Equations for the amplitude are derived using analyticity and unitarity. NSA

N66-27346# California Univ., Livermore. Lawrence Radiation Lab.

POSITRON FOCUSING IN AN ACCELERATING FIELD

Gay Hong 1 Jan. 1965 13 p refs
(Contract W-7405-ENG-48)
(UCRL-7566, Rev. 1) CFSTI: HC $1.00/MF $0.50

The equation of motion of positrons (or electrons) in an accelerating field and a focusing magnetic field is analyzed with relativistic effects included. An iterative procedure is used to solve the resulting nonlinear differential equation. An example is included to illustrate this technique; it is found that the assumptions involved are consistent with the numerical calculations. The feasibility of the proposed focusing scheme can be determined from the results obtained by this method of analysis. Author (NSA)

N66-27348# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Obninsk (USSR). Fiziko-Energeticheskii Institut.

YIELD AND ANGULAR DISTRIBUTION OF SECONDARY NUCLEONS FROM FLAT SHIELDING UNDER THE ACTION OF 660-MeV PROTONS [VYKHOD I UGLOVOE RASPREDELENIE VTORICHNYKH NUCLONOV IZ PLOSKIKH ZASHCHIT POD DEISTVIEM PROTONOV S ENERGIEI 660 MeV]

V. A. Kon'shin, E. S. Matusevich, and V. I. Regushevskii 1965 21 p refs In RUSSIAN *Its* Rept.-8
(NP-15385)

Angular distributions and yields of secondary nucleons behind plane shielding from C, Al, Ni, and Pb were measured. The number of nucleons was obtained in three energy groups. The 660-Mev proton beam was incident perpendicular to the shield. Results are compared with published data. Author (NSA)

N66-27350# India. Dept. of Atomic Energy, Bombay.

CDC-3600 FORTRAN CRYSTALLOGRAPHIC PROGRAMS FOR NEUTRON DIFFRACTION. PART I: NP-SFLS 1

S. Srikanta 1965 34 p ref
(AEET-203)

A description is given of the CDC-3600 computer program for the least squares refinement of crystal structure parameters based on neutron diffraction measurements. The complete program, written in Fortran language, is for refining two dimensional data with isotropic temperature factors. This program can be easily modified for refining three dimensional data and with anisotropic temperature factors.

Author (NSA)

N66-27356# California Univ., Berkeley. Lawrence Radiation Lab.

BRANCHING RATIOS IN K^+ MESON DECAY

Poh-shien Young (Ph.D. Thesis) 15 Sep. 1965 77 p refs
(Contract W-7405-ENG-48)
(UCRL-16362) CFSTI: HC $3.00/MF $0.75

A comprehensive study of the branching ratios in K^+ meson decay was carried out by reviewing previous work and performing a new experiment. For this research a beam of 10^8 K^+ mesons was brought to rest in a volume of 14 cc within a large stack of nuclear emulsions. The stack was designed so that the secondaries of the longest range could be followed to rest if the directions of their emission lie within certain cones. Some 700 K^+ decays for which each secondary was emitted in the selected cones were chosen as the sample for the experiment. The principal method for identifying the secondaries was following the track to rest, thus avoiding many sources of systematic error. Ionization measurements were used to resolve ambiguities. The overall efficiency for finding events was found to be higher than 95% and the relative efficiencies for the various modes were evaluated. The corrected branching ratios for the $K_{\mu 2}$, $K_{\mu 3}$, $K_{\pi 2}$, τ, τ', and K_{e3} were found to be 61.8 ± 2.9, 5.4 ± 0.9, 19.3 ± 1.6, 6.0 ± 0.4, 2.3 ± 0.6, and 5.3 ± 0.9 respectively. Author (NSA)

N66-27369# Oak Ridge National Lab., Tenn. Oak Ridge Central Data Processing Facility.

SPCTRM—AN 05R MONTE CARLO ANALYSIS ROUTINE FOR CALCULATING THE NEUTRON ENERGO SPECTRUM

G. W. Morrison, J. T. Mihalczo, and D. C. Irving 26 Aug. 1965 17 p ref
(Contract W-7405-ENG-26)
(ORNL-TM-1245) CFSTI: HC $1.00/MF $0.50

SPCTRM is a FORTRAN subroutine for analyzing the collision tapes from the 05R Monte Carlo neutron transport

code to obtain the energy spectrum of neutrons crossing a boundary, of neutrons in the medium, and of source neutrons, using equal energy intervals or equal logarithmic energy intervals. It also computes the fraction of neutrons leaking from the system and the average number of collisions before the neutrons are lost. The standard deviations of the neutron spectra are also determined. Author (NSA)

N66-27360# Oak Ridge National Lab., Tenn.
RCS-2: A FORTRAN PROGRAM FOR THE CALCULATION OF CROSS SECTIONS FROM RESONANCE PARAMETERS
W. E. Thomas and M. E. Tsagaris 7 Jul. 1965 23 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1396) CFSTI: HC $1.00/MF $0.50

The program evaluates point microscopic absorption, fission, scattering, and total cross sections from resonance parameters by the Breit–Wigner single level formula. All cross sections are computed in the laboratory system of coordinates. Options are available for normalizing absorption cross sections to an input 2200 m/s value, computing 1/E flux weighted average group cross sections for any desired group structure, and evaluating the parameters E_o and Γ_n for a possible "negative energy resonance." RCS-2 is written in FORTRAN for the IBM 7090. Author (NSA)

N66-27362# Oak Ridge National Lab., Tenn.
A GAUSSIAN QUADRATURE PROCEDURE USEFUL FOR THE NUMERICAL COMPUTATION OF BICKLEY FUNCTIONS AND SIMILAR INTEGRALS; REMARKS ON EXTRAPOLATION IN ITERATIVE PROCEDURES; AN APPROXIMATION TO e^x FOR SMALL x
Melvin Tobias 5 Nov. 1965 14 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1417) CFSTI: HC $1.00/MF $0.50

Three topics in numerical analysis which arose in the course of investigations into neutron transport theory are discussed. The first is a description of a Gaussian quadrature scheme useful in evaluating Bickley functions and similar integrals of functions of sin θ and cos θ over the range $0 \leq \theta \leq \pi/2$. The methods used in devising this procedure suggested an application to the second topic, extrapolation in iterative procedures. The third subject concerns approximation to e^x for small x; a formula is given which is helpful in evaluating certain expressions which are indeterminate at x=0. Author (NSA)

N66-27364# Oak Ridge National Lab., Tenn.
CERTAIN DEFINITE INTEGRALS OF BICKLEY AND BESSEL FUNCTIONS
Melvin Tobias 30 Nov. 1965 5 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1415) CFSTI: HC $1.00/MF $0.50

While investigating the numerical integration of the Boltzmann equation, certain definite integrals of Bickley and Bessel functions, such as $\int_0^{\pi/2} Ki_2(2a \cos \phi)\, d\phi$, $\int_0^{\pi/2} \cos 2\sigma K_0(2a \cos \phi)\, d\phi$, and $\int_0^{\pi/2} K_1(2a \cos \phi) \cos \phi\, d\phi$, were evaluated analytically. As the results may be useful for other purposes, they are reported together with the derivations. Author (NSA)

N66-27365# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
"A GENERAL PROPAGATOR" FOR THE MESONS WITH SPIN 2, 1, 0 IN SYMMETRY THEORY ["OBSHCHII PROPAGATOR" DLYA MEZONOV SO SPINAMI 2,1,0 V TEORII SIMMETRII]
Cao Chi 1965 6 p refs In RUSSIAN
(JINR-P-2474)

The propagators for particles with spins 2,1,0 are obtained with the help of symmetry theory. It is shown that these propagators can be united in a "general propagator" in the case when the considered particles belong to the same representation. It is a new situation that occurs only in symmetry theory. In order to obtain a true propagator for the particle with a definite spin from the "general propagator" the projection operators are introduced. Author (NSA)

N66-27368# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
SEARCH FOR NEW DECAY MODES OF THE K^0_2-MESONS [POISCI NOVYKH SKHEM RASPADA K^0_2-MEZONA]
M. Anikina, G. Vardenga, M. Zhuravleva, D. Kotlyarevskii, V. Novikov et al 6 Dec. 1965 11 p refs In RUSSIAN
(JINR-P-2488)

The kinematical analysis of the 1116 well measurable K^0_2 decays recorded in a cloud chamber yield no decay of the types $K^0_2 \to e^+e^-$, $K^0_2 \to \mu^\pm e^\pm$ and $K^0_2 \to \mu^+\mu^-$. This gives $W \leq 1.2 \times 10^4\ s^{-1}$ for the upper limit of the probability of these processes. Events of the type $K^0_2 \to \pi^+\pi^-\gamma$ were not found in which the γ-quantum would have given an electron-positron pair in a lead plate where $W(K^0_2 \to \pi^+\pi^-\gamma) \leq 2 \cdot 10^5\ s^{-1}$. Among the decays analyzed no events with anomalously large decay energy were observed. Author (NSA)

N66-27369# Joint Inst. of Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
SU(6) AND THE OPERATORS CPT AND C
A. Ul'mann 13 Jan. 1966 10 p refs
(JINR-E-2545)

The operators CPT and C are constructed in the SU(6) scheme, supposing that their general structure is already fixed within the domain of validity of SU(6). There is no ambiguity for the electromagnetic charge conjugation. The strong charge conjugation involves, however, a real parameter, that affects states with $B-Y \neq 0$. Author (NSA)

N66-27370# Oak Ridge National Lab., Tenn.
TRANSITION RADIATION OF A CHARGED RELATIVISTIC PARTICLE IN THE OPTICAL FREQUENCY RANGE
V. E. Pafomov and I. M. Frank [1966] 19 p refs Transl. into ENGLISH from Akad Nauk, SSSR, Inst. Fiz. (Moscow), 1965
(ORNL-TR-1062) CFSTI: HC $1.00/MF $0.50

The transition radiation is examined for a charged relativistic particle in the optical frequency range. The results of calculations of radiation intensity are reported, as a function of the magnitude of the real and imaginary parts of the refractive index. The problem of the possibility of using transition radiation for measuring the optical properties of metals is discussed. NSA

N66-27371# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
INELASTIC SCATTERING OF ELECTRONS ON NUCLEI WITH COLLECTIVE LEVEL EXCITATION [NEUPRUGOE RASSEYANIE ELEKTRONOV NA YADRAKH S VOZBUZHDENIEM KOLLEKTIVNYKH UROVNEI]
I. Zh. Petkov, V. K. Luk'yanov, and Yu. S. Pol 10 Dec. 1965 18 p refs In RUSSIAN
(JINR-P-2490)

Inelastic scattering of electrons on medium-weight and heavy nuclei was treated in the adiabatic approximation. A

distortion of the electron wave in the field of the nucleus is taken into account in the high energy approximation. An analytical expression was obtained for the scattering amplitude in terms of the sum of residues in the poles of the Fermi distribution of the charge density in the nucleus. The effect of "multiple" transitions on the elastic scattering cross section is estimated. It turns out that they may not be taken into account. The calculations made by the obtained analytical formulas are compared with experiment. Author (NSA)

N66-27373# Kernforschungsanlage, Juelich (West Germany). Institut für Physikalische Chemie.
COMPARATIVE INVESTIGATIONS ON COUNTING METHODS FOR THE ABSOLUTE DETERMINATION OF THE ACTIVITY OF ALPHA EMITTERS [VERGLEICHENDE UNTERSUCHUNGEN UBER ZAHLMETHODEN ZUR ABSOLUTBESTIMMUNG DER AKTIVITAT VON ALPHA-STRAHLERN]
H. Ihle, M. Karayannis, and A. Murrenhoff Sep. 1965 70 p refs In GERMAN; ENGLISH summary
(JUL-298-PC)

In order to improve the accuracy in absolute counting of alpha emitters, a comparative investigation was made of 4π counting with liquid scintillators and with proportional counters. The sources of errors in these methods were studied, and conditions were found under which the results obtained by the two methods agree within a few tenths of a percent. A device for nondestructive testing of the electric conductivity of thin foils used on 4π source carriers is described. NSA

N66-27376# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
CONDITIONS OF MACROSCOPIC CAUSALITY FOR THE SCATTERING MATRIX
D. I. Blokhintsev and G. I. Kolerov 20 Dec. 1965 14 p refs Submitted for Publication
(JINR-E-2500)

The macroscopic causality condition is formulated for the scattering matrix. An example of unitary but nonlocal scattering matrix which satisfies macroscopic causality requirements is given. Author (NSA)

N66-27377# Paris Univ. (France).
LINEAR ACCELERATOR LABORATORY REPORT OF ACTIVITIES, 15 APRIL–15 OCTOBER 1965 [LABORATOIRE DE L'ACCELERATEUR RAPPORT D'ACTIVITE, 15 AVRIL–15 OCTOBRE 1965]
Nov. 1965 68 p refs In FRENCH
(LAL-1148)

The improvement and utilization in the accelerator is summarized, together with research progress on nuclear physics, nuclear spectroscopy, pion physics and storage rings. Development of associated experimental equipment and radiation control are also reported. A bibliography of the publications during this period is appended. NSA

N66-27378# Joint Inst. of Nuclear Physics, Dubna (USSR). Lab. of Theoretical Physics.
A REMARK ON SU(6)$_w$ SYMMETRY [ZAMECHANIE O SIMMETRII SU(6)$_w$]
O. G. Bokov 24 Dec. 1965 8 p refs In RUSSIAN Submitted for Publication
(JINR-P-2513)

SU(6)$_w$ symmetry scheme is discussed. It is shown that the method suggested in Lipkin's and Meshkov's paper (Phys. Rev. Lett., 14: 670(1965)) is non-covariant. The meson–baryon vertex is considered. Author (NSA)

N66-27379# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
RADIATIVE DECAY OF 1^+ MESONS AND UNITARY SYMMETRY [RADIATSIONNYI RASPAD 1^+-MEZONOV I UNITARNAYA SIMMETRIYA]
Dao Wong Duc 3 Nov. 1965 6 p refs In RUSSIAN Submitted for Publication
(JINR-P-2419)

A general expression is given for the radiative decay of 1^+ mesons. Relations between widths in the unitary symmetry scheme are presented. Author (NSA)

N66-27380# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
PROBLEM OF COMBINATION OF THE SPACE AND INTERNAL SYMMETRIES OF ELEMENTARY PARTICLES [OB OB'EDINENII PROSTRANSTVENNOI I VNUTRENNEI SIMMETRII ELEMENTARNYKH CHASTITS]
D. Stoyanov 18 Nov. 1965 12 p refs In RUSSIAN
(JINR-P-2443)

The construction of the G group suggested by Michel is considered. This group combines space P and internal S symmetries. S being a normal denominator of G and P=G/S. It is shown that such a construction is obtained in the investigation of the automorphisms of the S group which results in an additional possibility for its equivalent representations (conventionally determined) to be classified according to the factor-group G/S. A general consideration of this problem leads to the fact that any combination S (if it is simple and compact) with the Poincaré groups is isomorphic to the direct product of these groups. Finally, the structure of the G group irreducible representation is considered. Author (NSA)

N66-27381# Joint Inst. of Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ON SYMMETRIES OF LEPTON–LEPTON INTERACTIONS [O SIMMETRIYAKH LEPTON–LEPTON LEPTONNYKH VZAIMODEISTVII]
N. N. Achasov and R. M. Muradyan 28 Dec. 1965 6 p refs In RUSSIAN Submitted for Publication
(JINR-P-2523)

Possible symmetries in a system of leptons were studied. The requirement that the lepton–lepton interaction lagrangian is independent of the electric charge is shown to be equivalent to the requirement of muon charge independence only for V–A theory. Author (NSA)

N66-27382# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ON THE GENERAL STRUCTURE OF AN OPERATOR WHICH IS MULTIPLICATIVE WITH RESPECT TO A SYMMETRY GROUP
A. Ul'mann 12 Jan. 1966 5 p refs
(JINR-E-2542)

An operator is said to be a multiplicative one with respect to a group, if $A(\omega_1 \times \omega_2) = A\omega_1 \times A\omega_2$ is valid for the Kronecker product. A theorem on the general structure of these operators was obtained. Author (NSA)

N66-27383# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ELECTROMAGNETIC PROPERTIES OF BARYONS AND MESONS IN NONRELATIVISTIC QUARK MODEL [ELEKTROMAGNITNYE SVOISTVA BARIONOV I MEZONOV V NERELYATIVISTSKOI MODELI KVARKOV]
S. B. Gerasimov 1965 10 p refs In RUSSIAN
(JINR-P-2509)

Assuming that the medium-strong interaction-breaking SU(3) symmetry leads to a change in mass and magnetic moment of the "strange" quark, the electromagnetic properties (magnetic moments, electromagnetic mass splitting, radiative decays, electromagnetic radii) of mesons and baryons are treated within the framework of nonrelativistic quark model. Author (NSA)

N66-27389# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
CONTRIBUTION TO THE STUDY OF THE ALPHA-ALPHA INTERACTION [CONTRIBUTION A L'ETUDE DE L'INTERACTION ALPHA-ALPHA]
Pierre Darriulat (Ph.D. Thesis—Paris Univ., Orsay, France) 24 Mar. 1965 96 p refs In FRENCH
(CEA-R-2786)

Two sets of measurements of the α-α elastic scattering differential cross section are presented. The first set—angular distributions from 50 to 120 MeV—shows resonances, 6^+ and 8^+, at 25 and 57 MeV. Complex phase shifts are extracted from the data and a phenomenological potential is given. A description of the 3 α-particle 0^+ states in ^{12}C is made with this interaction potential. The second set—excitation curves between 20 and 50 MeV—allows investigation of the ^8Be level structure within this energy range. The 16.6 and 16.9 MeV states are identified as 2^+, but the rise of inelastic processes at higher energies makes further identification of spins and parities difficult. Author (NSA)

N66-27390# Connecticut Univ., Storrs. Dept. of Physics.
COINCIDENCE STUDY OF O^+ ON Kr COLLISIONS
Quentin C. Kessel and Edgar Everhart 1 Feb. 1966 20 p refs Prepared for Sandia Corp., Albuquerque, N. Mex.
(Contract AT(30-1)-2047)
(TID-22648) CFSTI: HC $1.00/MF $0.50

The reaction $O^+ + Kr \rightarrow O^{m+} + Kr^{n+} + (m+n-1)e$ was studied in the energy range from 25 to 230 kev. Scattering of the oxygen ion to angles of 10 to 40° was considered. The charge states of the resultant ions were determined, together with the energy losses of the ions. NSA

N66-27400# National Inst. for Research in Nuclear Science, Harwell (England). Rutherford High Energy Lab.
AN INTRODUCTION TO THE HIGHER SYMMETRIES
Archibald W. Hendry Jun. 1965 96 p refs Lectures Presented Mar.-Apr. 1965
(RHEL/R-102)

Symmetry theory is discussed from its early beginnings. The SU(3) and SU(6) groups are then discussed in detail. NSA

N66-27403# Princeton-Pennsylvania Accelerator, Princeton, N. J.
EXPERIMENTAL INVESTIGATION OF SOME NEUTRON-DEFICIENT NUCLEI
J. S. Evans (Ph.D. Thesis) 1 Dec. 1965 217 p refs
(Contract AT(30-1)-2137)
(PPAD-572F) CFSTI: HC $6.00/MF $1.25

A windowless flow-type proportional counter was used to detect the 1.5-kev M X-rays and Auger electrons emitted following the decay of ^{163}Ho by orbital electron capture from the atomic M shell. A preliminary value of (33±23) yr was obtained for the half life of ^{163}Ho. A six-gap electron spectrometer was adjusted and calibrated for use in beta-ray and conversion electron studies. The spectrometer was used both for recording conversion electron spectra and for obtaining conversion electron-gamma-ray coincidence spectra in studies of some palladium and rhodium isotopes. Using a time-to-amplitude converter, the half life of the 75-kev state in ^{100}Rh was measured to be 235±3 nsec. The g-factor of this same state was determined by the time-differential angular correlation method to be +2.13±0.03. A novel method for rapidly dissolving bulk rhodium metal was devised. The rhodium is fused with molten zinc to form a rhodium-zinc alloy, which is then converted to a water-soluble form by a second fusion with potassium hydrogen sulfate. Carrier-free radiochemical procedures are described for preparing sources of palladium and rhodium species. A general survey of the mass 100 region was made using the spherical shell model as a guide. The systematics of the single-particle proton and neutron states, $39 \leq Z \leq 49$ and $51 \leq N \leq 81$, were used to correlate existing data in odd-A nuclei and to suggest where to look for additional states which have not yet been located. The collective states in both even-even and odd-A nuclei were found to agree fairly well with the model of collective vibrations about the spherical equilibrium shape. The Brennan-Bernstein coupling rules were used to correlate the spins and magnetic moments of levels in odd-odd nuclei with those for levels in adjacent odd-A nuclei. The nuclei near mass 100 were compared with nuclei at the beginning and end of the deformed rare earth region, in order to look for possible nonspherical equilibrium shapes. Several experimental criteria for distinguishing between the spherical and spheroidal shapes are discussed and applied to the ruthenium and palladium isotopes. Although the well studied nuclides seem to be adequately described by the spherical approximation, it is pointed out that spheroidal shapes might be encountered for ^{102}Ru and ^{114}Pd. NSA

N66-27405# Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.
THE ENERGY AND ANGULAR DISTRIBUTION OF PHOTONEUTRONS FROM HEAVY ELEMENTS
W. Bertozzi, S. Kowalski, G. S. Mutchler, C. P. Sargent, and W. Turchinetz [1965] 19 p ref Presented at Gordon Res. Conf. on Ion Exchange, New London, N. H.
(Contract AT(30-1)-2098)
(MIT-2098-162; CONF-650817-2) CFSTI: HC $1.00/MF $0.50

Photoneutron energy spectra are measured using time-of-flight methods at emission angles of 24 to 156°, using bremsstrahlung having a maximum energy of 18 MeV, for 14 elements. Data are also measured for the Pb isotopes having mass numbers of 206, 207, and 208. NSA

N66-27407# Stanford Univ., Calif. High-Energy Physics Lab.
ELASTIC SCATTERING OF HIGH ENERGY ELECTRONS FROM DEUTERIUM
Edwin Francis Erickson Dec. 1965 260 p refs
(Contract Nonr-225(67))
(HELP-423; AD-630624) CFSTI: HC $25.00/MF $1.25

The purposes of the present work are: (1) To investigate the method of elastic electron-deuteron scattering by detection of the recoil target nucleus. (2) To evaluate existing theory for the scattering process in light of the recent advances in understanding nucleon structure and the nuclear force. (3)

To provide experimental data at values of the momentum transfer where none had previously existed. Some fundamental preliminary considerations are discussed in Chapter II. Chapter III contains a summary of theoretical aspects of the problem and results of calculation. Some basic experimental questions are answered in Chapter IV. In Chapter V the experimental apparatus is described. The data, method of analysis, and corrections are discussed in Chapter VI. In the last chapter a comparison of the experimental results with theoretical predictions is made, and conclusions and suggestions for further work are given. TAB

N66-27440# Michigan Univ., Ann Arbor. Dept. of Physics.
ON THE A, T-DEPENDENCE OF COULOMB ENERGIES
K. T. Hecht [1965] 11 p refs Presented at the Tallahassee Conf. on Isobaric Spin in Nucl. Phys., Fla.
(Contract Nonr-1224(59))
(AD-630886) CFSTI: HC $1.00/MF $0.50

The five-dimensional quasispin formalism has been used to extract the A,T-dependent factors of the Coulomb energy (diagonal matrix elements) in states of low reduced isospin. In particular, in a simple configuration j^n and states with seniority $v=0$ ($t=0$) and $v=1$ ($t=1/2$) the iso-vector and tensor parts of the Coulomb energy are given. Author

N66-27454# California Univ., Livermore. Lawrence Radiation Lab.
TABULATED NEUTRON-INDUCED GAMMA PRODUCTION CROSS SECTION FOR PRIMARY NEUTRON ENERGIES OF 0.1 TO 15 MEV
Nanette Chazan 23 Aug. 1965 125 p
(Contract W-7405-ENG-48)
(UCRL-14007, Rev. 1) CFSTI: HC $4.00/MF $0.75

Gamma-production cross sections, both integrated and differential, are tabulated. The data are categorized according to whether the gammas produced are continuum, discrete, or total over all gamma energies. Author (NSA)

N66-27466# Oak Ridge National Lab., Tenn.
INELASTIC SCATTERING AND THE DISTORTED WAVE METHOD
F. G. Perey [1965] 27 p refs Presented at the Am. Phys. Soc., Gatlinburg, Tenn.
(Contract W-7405-ENG-26)
(ORNL-P-1957; CONF-651118-9) CFSTI: HC $2.00/MF $0.50

The determination of spin and parity of nuclear levels from the analysis of inelastic scattering angular distributions using the distorted wave method is discussed. Applications of the collective and optical models for spin and parity assignments are discussed. Various examples point out the usefulness of these methods. NSA

N66-27467# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
SMALL ANGLE ELASTIC SCATTERING OF POLARIZED PROTONS IN PHOTOGRAPHIC EMUSIONS
E. Beltrametti, G. Boebel, A. Gigli, C. Lamborizio, I. Ortalli et al Sep. 1965 13 p refs
(RT/FI(65)35)

Elastic scattering experiments of polarized (89%) protons of 215 MeV energy in photographic emulsions were performed. The right-left asymmetry $\epsilon(\theta)$ was measured at small scattering angles (of the order of a few degrees); the results give indications of a sign change of the asymmetry at a scattering angle of about 4°, though the statistics are too poor to give a definite answer for the behavior of the asymmetry around $\theta=4°$. The theoretical implications of the observed behavior of $\epsilon(\theta)$ at small θ are discussed taking into account coulomb interaction effects. The conclusion is that the coulomb interference could give rise to a large "anomalous" behavior of $\epsilon(\theta)$ at small angles (1° +5°) of the same kind as the one suggested by the experimental data. However it is to be remarked that the calculated effects are strongly dependent on the approximation used to calculate the scattering amplitudes. Author (NSA)

N66-27472# Cambridge Electron Accelerator, Mass.
SUMMARY OF RESEARCH OPERATIONS AT THE CAMBRIDGE ELECTRON ACCELERATOR
M. Stanley Livingston 10 Jan. 1966 19 p refs
(Contract AT(30-1)-2076)
(CEAL-1026) CFSTI: HC $1.00/MF $0.50

The photoproduction of a number of particles and pairs was investigated; two of the studies were concerned with testing the validity of quantum electrodynamics. The form factors of the deuteron and nucleons were studied by observing e-d and e-p scattering, respectively. The production of polarized photons with a laser was also investigated, as was the use of wide-gap spark chambers. The elastic scattering of high-energy positrons by protons was studied, and the existence of Compton scattering of photons from protons was demonstrated. The beam facilities were improved and colliding-beam facilities were considered. NSA

N66-27478# Joint Inst. for Nuclear Research, Dubna, (USSR). Lab. of Nuclear Problems.
ASYMMETRY IN THE ANGULAR DISTRIBUTION OF THE HIGH-ENERGY NEUTRONS FROM MU⁻ CAPTURE IN SULFUR
V. S. Evseev, V. A. Chernogorova, F. Kilbinger, V. S. Roganov, and M. Shimchak 1965 10 p refs
(JINR-E-2516)

The asymmetry coefficient B in the angular distribution of high energy neutrons from meson (μ^-) capture in sulphur was measured. The value of the asymmetry coefficient reduced to 100% of meson (μ^-) residual polarization is close to −1, which contradicts calculations on the basis of the universal weak interaction theory. Author (NSA)

N66-27479# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
ANGULAR DISTRIBUTION OF HIGH-ENERGY NEUTRONS EMITTED IN ABSORBING POLARIZED μ^--MESONS IN CALCIUM
V. S. Evseev, Run-Hwa Chang, V. A. Chernogorova, V. S. Roganov, and M. Shimchak 1965 30 p refs Submitted for Publication
(JINR-E-2517)

The asymmetry coefficient B was measured in the angular distribution of neutrons from mesons (μ^-)-capture in Ca in the E_n energy range from 6.7 to 20.7 MeV. For higher thresholds ($E_n \geq 18$ MeV) the asymmetry coefficient reduced to the 100% residual polarization of mesons (μ^-) is close to −1, which contradicts calculations on the basis of the universal weak interaction theory. Author (NSA)

N66-27483# Atomics International, Canoga Park, Calif.
AGE OF FISSION NEUTRONS TO INDIUM RESONANCE ENERGY IN IRON–WATER MIXTURES. PART II: THEORY

H. Alter [1965] 78 p refs
(Contract AT(11-1)-Gen-8)
(NAA-SR-Memo-10918) CFSTI: HC $3.00/MF $0.75

The Monte Carlo Code, TYCHE-III, has been used to calculate with a high degree of convergence the second, fourth, and sixth spatial moments of the slowing down density distribution at the indium resonance energy, for neutrons originating from a fission source at a point in infinitely extended iron-water moderator. The effects of both inelastic scattering and anisotropy of elastic scattering in oxygen and iron have been included. These calculations have been compared with the moments of experimentally measured distribution of neutron flux at the indium resonance energy, after applying a suitable correction to the computed slowing down moments.
Author (NSA)

N66-27485# Massachusetts Inst. of Tech., Cambridge.
THE ANGULAR DISTRIBUTIONS AND ENERGY SPECTRA OF PHOTONEUTRONS FROM HEAVY ELEMENTS
Gordon Sinclair Mutchler (Ph.D. Thesis) Feb. 1966 307 p refs
(Contract AT(30-1)-2098)
(MIT-2098-224) CFSTI: HC $7.00/MF $1.50

The energy spectra of photoneutrons from Bi, ^{208}Pb, ^{207}Pb, ^{206}Pb, Tl, Hg, Au, W, Ta, Er, Ho, Sm, Pr, La, I, Sn, and In were measured at 24, 76, and 156° relative to the photon beam from the MIT Linear Accelerator. Bremsstrahlung spectra were used with endpoints of 15, 14 and 13 Mev. The neutron energies were determined using a time-of-flight spectrometer with 10 meter flights paths and 8 ns resolution. generated by an equivalent photon spectrum peaked at 14 Mev from the 15-Mev (or 14 Mev) data yields neutron spectra generated by an equivalent photon spectrum peaked at 14 Mev (or 13 Mev) with a full width at half maximum of 2 Mev. The angular distributions of the photoneutron spectra from these three bremsstrahlung spectra were analyzed in the form $W(\theta)=a_0+a_1P_1(\cos\theta)+a_2P_2(\cos\theta)$. a_1 was found to be approximately constant with energy for each target and to range from −0.07 to +0.05 with statistical errors of ±0.02 and estimated systematic errors of ±0.09. Therefore, a_1 was assumed to be zero for all targets; and the angular distributions are presented in the form $W(\theta)=a_0+a_2P_2(\cos\theta)$. The anisotropy ($a_2/a_0$) was found to increase with neutron energy. The low energy photoneutrons (<3 Mev) are isotropic ($a_2/a_0=0$) and the anisotropy is a maximum at or near the neutron endpoint. This maximum value of the anisotropy shows marked shell effects. It is a maximum ($-a_2/a_0=0.6$ to 0.7) near the closed shell nuclei ^{208}Pb and Pr, and it has a minimum ($-a_2/a_0=0.15$ to 0.3) between these two closed shells, in the region of the deformed nuclei. The neutron difference spectra are characterized by an isotropic evaporation component which dominates at low neutron energies, and an anisotropic resonance direct component which dominates at high neutron energies. The transition from one component to the other is quite abrupt, typically taking place in an energy interval of about one to two Mev. It was found to be possible to fit the neutron difference spectra with the theoretical curve $dN/dE_n=$ const $E_n\sigma\subset\omega(U)+kS(E_n)$, where $\omega(U)$ is the level density of the residual nucleus at an excitation energy U, $\sigma\subset$ is the inverse capture cross section, and $S(E_n)$ is the energy spectrum of the direct component. The data were analyzed using three approximations for the level density, $(\exp 2\sqrt{a_{3/2}U})/(U+t)^{3/2}$, $(\exp 2\sqrt{a_2U})/(U+t)^2$, and $\exp(-E_n/T)$, where t is given by the equation $U=a_mt^2-t$. $S(E_n)$ was calculated using Wilkinson's model of the giant resonance. In the above equations, a_m (or T), and k were the only adjustable parameters. The values of a_2 generally follow the predictions of Newton, $a_2=K(i_x+i_y+1)A^{2/3}$. K was found to be 0.067. The fraction of directly emitted neutrons, f, defined as the integral of the direct spectrum divided by the integral of the total spectrum, was found to be about 14% and approximately constant with A, the mass number.
Author (NSA)

N66-27522# Rochester Univ., N. Y. Dept. of Physics and Astronomy.
ALGEBRA OF CURRENTS AND THE MAGNETIC MOMENTS OF HYPERONS
V. S. Mathur and L. K. Pandit 7 Jan. 1966 11 p refs Submitted for Publication
(Contract AT(30-1)-875)
(UR-875-118) CFSTI: HC $1.00/MF $0.50

Using equal time commutations relations of the strangeness-changing axial-vector "charges" with the isoscalar and isovector electromagnetic current densities, the magnetic moments of Σ^+ and Λ and the Σ^0-Λ transition magnetic moment were calculated in terms of strange particle photoproduction amplitudes, which are evaluated using low lying baryon resonant states. The results agree very well with the experimental values available for Σ^+ and Λ magnetic moments.
Author (NSA)

N66-27546# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
DOUBLE TIME-OF-FLIGHT FAST NEUTRON SPECTROMETRY AND STUDY OF THE REACTION ^{9}Be (n,2n) [ESPECTROMETRIE DE NEUTRONS RAPIDES A DOUBLE TEMPS-DE-VOL ET ETUDE DE LA REACTION ^{9}Be(n,2n)]
Jean-Claude Gonrand (Ph.D. Thesis—Grenoble Univ.) 1965 52 p refs In FRENCH
(CEA-R-2734)

The interaction between 14.5-Mev neutrons and ^{9}Be was studied by a double time-of-flight method. Energies of the (n,2n) reaction were measured with the two neutrons being in the same plane with the incident neutron and scattering angle 30°. The events were identified by the electronic method with photographic control) and by the kinematics corresponding principally to formation of resonance states between particles 2α and 2n of the final state: ^{8}Be(0)$\sigma\simeq$ 170 mb, ^{8}Be(2.9 MeV)$\sigma\sim$ 165 mb, and ^{9}Be(6.67 MeV)^{9}Be(0)$\sigma\simeq$ 95mb.
NSA

N66-27589# RAND Corp., Santa Monica, Calif.
POTENTIAL ENERGY CURVES FOR N_2, NO, O_2, AND CORRESPONDING IONS
F. R. Gilmore Apr. 1966 50 p refs Submitted for Publication
(Contract AF 49(638)-1700; Proj. RAND)
(RM-4034-1-PR; AD-630997) CFSTI: HC $3.00/MF $0.50

Potential energy curves for the observed electronic states of N_2, $N_2(+)$, NO, NO (+), O_2 and O_2 (+) were calculated from published spectroscopic data by a numerical modification of the Rydberg-Klein method. Potential energy curves for a number of predicted but unobserved states of these molecules, and of the ground states of N_2 (−) (unstable), NO (−) and O_2 (−), were estimated with the help of simple theoretical considerations, published quantum-mechanical calculations, and indirect experimental evidence. The results are presented graphically.
Author (TAB)

N66-27832# University of Southern Calif., Los Angeles. Dept. of Physics.
FLUORESCENCE SPECTRA OF THE MOLECULAR ION O_2^+, N_2^+ AND CO^+ EXCITED BY VACUUM ULTRAVIOLET RADIATION

D. L. Judge and G. L. Weissler 31 Aug. 1965 111 p refs
(Contract Nonr-228(27); Proj. Defender)
(USC VacUV-105; AD-631482) CFSTI: HC $4.00/MF $0.50

Vacuum ultraviolet photon-gas interactions leading to fluorescence in the visible wavelength region are presented for the gases O_2, N_2, and CO. This fluorescence is wavelength analyzed, and the results are discussed in terms of either known molecular structure or structure implied by the present experimental results. It is argued that the observed fluorescence is primarily from excited states of molecular ions for each of the gases studied. The primary VUV radiation, obtained from a repetitive condensed spark discharge through 50 microns of air, consisted of a number of bright source lines between 1000 and 500 A (12 to 24 eV). Each gas was studied in terms of the fluorescence resulting from excitation by several of the primary source lines, differing from each other by approximately 0.15 eV, an energy difference comparable to the separation of typical low lying vibrational levels. The fluorescence wavelength analysis was obtained with a high aperture Czerny–Turner type monochromator having a bandwidth of 40 to 70 A, the particular value selected being determined by the signal to noise ratio at the fluorescence photon counter. Author (TAB)

N66-27685# Westinghouse Electric Corp., Pittsburgh, Pa. Research Lab.
STUDY AND EXPERIMENTAL WORK ON ATOMIC COLLISION PROCESSES OCCURRING IN ATMOSPHERIC GASES Technical Progress Letter 43, 1 Jun.–31 Aug. 1965
31 Aug. 1965 4 p
(Contracts AF 29(601)-6729; Nonr-2584(00); ARPA Order 125)
(RM-65-6E2-113-M3; AD-31485) CFSTI: HC $1.10/MF $0.50

Progress of work in the following areas is reported: temperature dependence electron-cation recombination in N_2-Ne mixtures; attachment and detachment in CO_2-O_2 mixtures and in pure water vapor; elastic and inelastic scattering cross sections for electrons in pure oxygen. TAB

N66-27699# California Univ., Los Angeles.
TABLE OF HARTREE–FOCK SELF CONSISTENT FIELD WAVE FUNCTIONS WITH EXCHANGE, SUPPLEMENT II Interim Report, 1964–1965
Robert D. Chapman and William H. Clarke Wright-Patterson AFB, Ohio, ARL, Jan. 1966 453 p refs
(Grant AF-AFOSR-83-65)
(ARL-66-0018; AD-631601) CFSTI: HC $7.55/MF $2.00

A table of Hartree–Fock self consistent field wave functions with exchange is presented for ions of the isoelectronic sequence Na I, ... Si IV. The configurations considered are 3s, 3p, 3d, 4s, . . . , 4f, 5s, . . . , 5g, 6s, . . . , 6h, 7s. Author (TAB)

N66-27702# Radiation Research Associates, Inc., Fort Worth, Tex.
GAMMA-RAY ENERGY AND ANGULAR DISTRIBUTIONS NEAR THE AIR/GROUND INTERFACE FROM PLANE FALLOUT AND POINT Co^{60} SOURCES
R. L. French and C. W. Garrett (Armed Forces Radiobiology Res. Inst.) Bethesda, Md., DASA, Nov. 1965 32 p refs
(Contract DA-49-146-XZ-254)
(RRA-M-42; AFRRI-CR-65-5; AD-631747) CFSTI: HC $3.60/MF $0.50

Monte Carlo techniques were applied in a detailed study of the gamma radiation environment three feet above the air/ground interface due to two types of gamma-ray sources: (1) fallout uniformly distributed on the ground surface, and (2) a Co^{60} point source also three feet above the ground at separation distances of 100 to 800 feet. In each case, the scattered and direct-beam fluxes were computed in each of ten receiver energy intervals between 0.04 and 3.5 Mev and eighteen equal receiver angle intervals between 0 (nadir) and 180 degrees (zenith). All results were integrated over azimuthal angle at the receiver to reflect distribution in polar angle only. The source energy was used as a parameter in the fallout calculations and the results thus computed for each of ten different source energies may be weighted and combined to obtain data for fallout of any desired age. Comparisons of the Monte Carlo data with measured data and with other calculated data, both for fallout and for Co^{60} point sources, show favorable agreement. Author (TAB)

N66-27734*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MONTE CARLO INTERPRETATION OF SPHERE TRANSMISSION EXPERIMENTS FOR AVERAGE CAPTURE CROSS SECTIONS AT 24 KeV
Donald Bogart and Thor T. Semler Washington, NASA, Jun. 1966 27 p refs Presented at the Conf. on Neutron Cross Section Technol., Washington, 22–24 Mar. 1966
(NASA-TR-R-239) CFSTI: HC $1.00/MF $0.50 CSCL 20H

Monte Carlo analyses of sphere transmission experiments at 24 keV are made by using statistical results from slow neutron resonance spectroscopy as input data. An average capture cross section σ_C for gold of 700 ±50 millibarns is obtained compared with a reported value of 532 ±60 millibarns evaluated by a widely used multiple scattering analysis. A small p-wave contribution is required for gold. For iodine s-wave and p-wave contributions of 442 ±50 and 358 ±60 millibarns, respectively, provide a σ_C of 800 ±80 millibarns. This value is in substantial agreement with a reported value of 768 ±90 millibarns. For nuclei with large s-wave scattering, such as gold, the usual multiple scattering analysis is shown to encounter difficulties because of ambiguity as to the effective scattering cross section to be used. Author

N66-27735*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BORON CROSS SECTIONS AS A SOURCE OF DISCREPANCY FOR CAPTURE CROSS SECTIONS IN THE KeV REGION
Donald Bogart Washington, NASA, Jun. 1966 23 p refs Presented at the Conf. on Neutron Cross Section Technol., Washington, 22–24 Mar. 1966
(NASA-TR-R-240) CFSTI: HC $1.00/MF $0.50 CSCL 20H

Discrepancies in capture cross sections for gold from 80 to 200 keV are explained by changes in boron ($n\alpha$) cross sections used to monitor neutron fluxes. These changes in boron cross sections are shown to improve agreement in capture data for iodine, indium, silver, antimony, and tantalum. Reexamination of the boron cross section measurements discloses that a modified long counter with considerable loss in efficiency below 200 keV had been used, but its response had been taken to be flat. Boron cross sections, corrected for long counter efficiency, depart significantly from an inverse neutron velocity variation (1/v) above ~80 keV. Author

N66-27766# Kernforschungsanlage, Juelich (West Germany). Institut für Reaktorwerkstoffe.
DISPERSION CURVES FOR ROTATION OSCILLATIONS OF TETRAHEDRAL MOLECULES IN A FACE-CENTERED LATTICE WITH TETRAGONAL MOLECULAR ORIENTATION [DISPERSIONSKURVEN FUR ROTATIONSSCHWINGUNGEN VON TETRAEDRISCHEN MOLEKULEN IN EINEM FLACHENZENTRIERTEN GITTER MIT TETRAGONALER MOLEKULORIENTIERUNG]

R. Stockmeyer Sep. 1965 24 p refs In GERMAN
(Jul-292-RW)

The rotation oscillation spectrum of molecular orientation with tetragonal symmetry was investigated in fcc lattices. Only Cartesian coordinates were used and the dispersion curves are given as a function of the corresponding coupling parameters. The complete motion equation is given and the perturbation calculation for the coupling between translational and rotational motions is described. The symmetry properties of the coupling matrices for rotation oscillations of very small amplitude were derived, and dispersion curves with general coupling parameters were calculated. The octupole interaction in Euler angles was considered along with the approximation of small angles in Euler coordinates. Dispersion curves are given for rotation oscillations with octupole interactions. NSA

N66-27769# California Univ., Berkeley. Lawrence Radiation Lab.
PRODUCTION PROPERTIES AND DECAY MODES OF THE ϕ MESON
James Seward Lindsey (Ph.D. Thesis) 21 Dec. 1965 74 p refs
(Contract W-7405-ENG-48)
(UCRL-16526) CFSTI: HC $3.00/MF $0.75

The reaction $K^-p \rightarrow \Lambda\phi$ was studied in an exposure of the LRL 72-inch bubble chamber to a separated beam of K^- mesons of 2.1 to 2.7 BeV/c momentum. The decay branching ratios for K^+K^-, $K_1^0K_2^0$, $\rho\pi$, $\eta\gamma$, $\pi^+\pi^-$, $\rho\gamma$, and $\omega\gamma$ were measured, and the ratio $\beta = [\Gamma(\phi \rightarrow K_1^0K_2^0)/\Gamma(\phi \rightarrow K^+K^-)]$ was used as a test of the ϕ's spin. The quantum numbers assigned to the ϕ, $J^{PG} = 1^{2-}$ and $I = 0$, were verified. An attempt was made to fit decay–angular distributions to several models, in order to further confirm the spin 1 assignment for the ϕ. However, the distributions are consistent with predictions for both spin 1 and spin 3, so that no independent test of spin is possible. Production processes were investigated with the correlation-matrix method of Berman and Oakes. The low-momentum (2.1 BeV/c beam momentum) data fit a model of K and K* exchange, but the high-momentum (2.45 to 2.7 BeV/c) data are inconsistent with the model. Also, other final states involving KK pairs were investigated, and their cross sections measured, but except for the production of the reaction $K^-p \rightarrow Y_1^*(1385)\phi$, no previously unreported effects were observed. Author (NSA)

N66-27788# National Inst. for Research in Nuclear Science, Harwell (England). Rutherford High Energy Lab.
P.L.A. Annual Progress Report No. 5, 9 Nov. 1964–12 Sep. 1965
R. C. Hanna and J. M. Dickson, ed. Dec. 1965 146 p refs
(RHELR-112)

Seven sections are included; separate abstracts have been prepared for 5. The remaining two sections are concerned with the operations and design modifications carried out during 1965 on the proton linac of the Rutherford High Energy Laboratory. NSA

N66-27784# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
VAPOR PRESSURE STUDIES OF URANIUM DIOXIDE (UO_2) BY THE EFFUSION METHOD [MESURE DE LA TENSION DE VAPEUR DU BIOXYDE D'URANIUM UO_2 PAR LA METHODE D'EFFUSION]
Roland W. Ohse Sep. 1965 64 p refs In FRENCH
(CEA-R-2871)

A high temperature apparatus for vapor pressure measurements by the Knudsen effusion method is described. The sample is heated in a tungsten cell in an electronic bombardment furnace. Several critical factors affecting the accuracy of measurements such as: temperature distribution and measurement in the effusion cell; Clausing factor and molecular flow; and compatibility between cell material and sample heated are discussed. The vapor pressure of UO_2 was studied between 2200 and 2800° K. Author (NSA)

N66-27785# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
RED CROSS: A CODE TO COMPUTE RESONANCE SHIELDED TEMPERATURE DEPENDENT CROSS SECTIONS FOR FAST REACTOR ANALYSIS
W. W. Little, Jr. and R. W. Hardie Aug. 1965 75 p
(Contract AT(45-1)-1830)
(BNWL-146) CFSTI: HC $3.00/MF $0.75

A code is described which uses extensive Russian data to compute resonance shielded, temperature dependent, 26-group cross sections. The output (printed or punched) is in a format suitable for fast reactor analyses using the corrected transport approximation. Author (NSA)

N66-27849# Stanford Univ., Calif. High Energy Physics Lab.
HIGH ENERGY ELECTRON SCATTERING AS A TEST OF THE NUCLEAR CLUSTER MODEL
T. A. Griffy, R. J. Oakes, and H. M. Schwartz Mar. 1966 19 p refs Submitted for Publication
(Contracts AF 49(638)-1389; Nonr-225(67))
(HEPL-430; ITP 207; AD-631176) CFSTI: HC $1.60/MF $0.50

The possibility of using high-energy electron scattering to investigate the cluster model of light nuclei is discussed. The general formulation of the electron-cluster coincidence cross section for processes of the type A (e,e'b)B is given. Final state interactions between the ejected cluster and the residual nucleus are taken into account using a square well optical-model potential. Finally, the formalism is applied to the process Li_6 (e,e'd) He_4 as an example. Author (TAB)

N66-27866# Applied Physics Lab., Johns Hopkins Univ. Silver Spring, Md.
VARIATIONAL PRINCIPLE FOR THE ENERGY OF QUASI-STATIONARY STATES
V. S. Rudakov 10 Feb. 1966 6 p refs Transl. into ENGLISH from Vestn. Leningrad. Univ., Ser. Fiz. i Khim. (Leningrad), Bull. no. 16, ser. no. 3, 1965 p 138–139
(Contract NOw-62-0604-c)
(TG-230-T462; AD-631013) CFSTI: HC $1.10/MF $0.50

The variational principle for the complex energy of the quasistationary states is formulated for the simplest case of zero angular momentum Schrodinger equation. Application of the variational principle to the perturbation theory and the numerical calculations for the particular case are given. Author (TAB)

N66-27910# Brookhaven National Lab., Upton, N.Y.
THE NEUTRON CROSS SECTION OF SODIUM BELOW 40 KeV
Thomas E. Stephenson Dec. 1965 23 p refs
(Contract AT(30-2)-GEN-16)
(BNL-961) CFSTI: HC $2.00/MF $0.50

The neutron cross section of sodium from 1 to 40 kev is calculated using the single level formula and BNL-325 resonance parameters for the 2.85-kev level. A good fit to the

data is obtained with the spin-dependent scattering radii $R'_+ = 5.85$ f and $R'_- = 5.18$ f. A good fit to the experimental data throughout the region was not found using a spin-independent scattering radius. The excess absorption resonance integral is calculated to be 0.072 barns and is in good agreement with experimental values. The scattering resonance integral is calculated to be 72 barns which compares favorably with an evaluated experimental result. The low energy potential scattering is described by spin-dependent square potential wells. Author (NSA)

N66-27915# Los Alamos Scientific Lab., N. Mex.
NEUTRON CAPTURE CROSS SECTIONS OF SOME RARE EARTH NUCLEI
George I. Bell Jan. 1966 16 p refs
(Contract W-7405-ENG-36)
(LA-3463-MS) CFSTI: HC $1.00/MF $0.50

Statistical theory was used to calculate neutron capture cross sections of some rare earth nuclei for neutron energies of 1 and 10 kev. For nuclei with measured low-energy resonance parameters, these parameters are used in the theory for s-wave capture; for other nuclei, the level density is computed from a semi-empirical expression, and the strength function and $\Gamma\gamma$ are determined by interpolation or extrapolation. Qualitative agreement was found with the experimental values of $\sigma(n,\gamma)$. Particular attention is given to the isotopes of Eu($Z = 63$) which probably have larger $\sigma(n,\gamma)$ than any other rare earths. Capture cross sections for the stable Eu nuclei ($A = 151$, 153) are large because of large strength functions and small competition from compound elastic scattering (i.e. small $\langle\Gamma_n\rangle$). The odd-odd Eu isotopes (especially ^{152}Eu) should have slightly larger $\sigma(n,\gamma)$ (because of even smaller $\langle\Gamma_n\rangle$), but their capture cross sections are unlikely to be more than about 20% larger than that for ^{151}Eu. Results for other nuclei are given. NSA

N66-27925# Argonne National Lab., Ill.
SURVEY OF POLARIZED ION SOURCES IN EUROPE
D. C. Hess and D. von Ehrenstein Nov. 1965 103 p refs
(Contract W-31-109-ENG-38)
(ANL-7118) CFSTI: HC $4.00/MF $0.75

A survey of polarized ion sources in Europe was made. The various ion sources discussed are located in England, France, Germany, Italy, Netherlands, and Switzerland. Author (NSA)

N66-27982# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.
CALCULATION OF HYDROGEN ATOM CROSS SECTIONS
F. Pomilla and S. Milford May 1966 37 p Addendum to RE-210
(RE-210; RE-210, Addend.)

Several tables detail cross sections for double-transition collisions of hydrogen atoms. Total cross sections are calculated for the cases when one atom is initially in the ground state and (1) $\Delta n = 1$ for both atoms and (2) $\Delta n \neq 1$ for the other atom. Total level cross sections are tabulated when one atom is initially in the ground state and $\Delta n \neq 1$ for the other atom; and experimental and theoretical cross sections are given for the excitation of hydrogen atoms by collisions of hydrogen molecules at $E_{LAB} = 10$ MeV. M.W.R.

N66-27988# European Organization for Nuclear Research, Geneva (Switzerland).
INFORMAL CONFERENCE ON EXPERIMENTAL NEUTRINO PHYSICS
C. Franzinetti, ed. Dec. 1965 364 p refs Proceedings of conf. held at CERN, 20–22 Jan. 1965
(CERN-65-32)

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10. NEUTRINO DETECTORS FOR FUTURE SOLAR AND COSMIC-RAY EXPERIMENTS R. Davis, Jr. et al (Brookhaven Natl. Lab.) p 201–239 refs
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12. SUMMARY OF THE CONFERENCE AND CLOSING REMARKS M. Goldhaber et al (Brookhaven Natl. Lab.) p 269–284

N66-27989# European Organization for Nuclear Research, Geneva (Switzerland). Nuclear Physics Apparatus Div.
FOCUSING AND CHROMATIC ABERRATIONS IN A PERIODIC AG BEAM TRANSPORT SYSTEM
E. Regenstrief 15 Dec. 1965 259 p refs
(CERN-65-42)

The purpose of this paper is to examine the focusing properties of a periodic beam transport system in the light of its AG behavior, and to consider the effect of chromatic aberrations in a channel of this type with particular reference to optimum mode and minimum aberrations. The latter have been compared to the aberrations under stigmatic conditions. The properties of the channel are first analyzed in terms of the thin lens approximation which reveals all important features of a system of this type. The thick lens approach then takes into account the fine structure of the system. The relevant characteristics are given in graphical form as a result of the calculations. The channel has been considered as a system in itself, i.e., although its properties are examined in view of subsequent matching, no attempt has actually been made here to match to the channel the source emittance or the detector acceptance. Author

N66-27998# European Atomic Energy Community, Brussels (Belgium).
NEUTOF—A PROGRAM TO CORRECT NEUTRON TIME OF FLIGHT SPECTRA
G. Verdan Apr. 1966 38 p refs
(EUR-2779.e) CFSTI: HC $2.00/MF $0.50

Under special consideration of the finite energy width of the incident neutrons and of the finite chopper burst-time a correction computer program is being developed. Thanks to the

free parameter choice it can be used for many inelastic and elastic neutron scattering problems. In the optional second section of the main program the generalized freuqncy distribution of the investigated solid can be calculated. The programs written in Fortran II are listed in chapter 3. Author

N66-27999# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
ON THE PHOTOPRODUCTION OF N* ON DEUTERON
D. Schiff and J. Tran Thanh Van May 1966 24 p refs
(TH-147) CFSTI: HC $1.00/MF $0.50

In order to study inelastic unitarity in deuteron photodisintegration, the photoproduction of N* on deuteron is calculated in the framework of impulse approximation. Predictions for the ratio of N* photoproduction on deuteron and deuteron photodisintegration cross-sections are given for a proton momentum ranging from 200 MeV to 700 MeV. It is shown that this ratio is measurable. Author

N66-28061# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
A NEW INVESTIGATION OF THE $^1S^e$-AUTOIONIZING STATES OF He AND H^-
Erling Holoeien and John Midtdal (Oslo Univ.) 2 Jun. 1966 37 p refs
(JILA-74)

The present investigation should provide some insight into the convergent properties of some particular upper roots of the full Hamiltonian. In this connection detailed calculations using the scaling–variation orthogonalization procedure with different subsets of the basis up to order 54 have been carried through both for He and H^-. Subsets including basic functions up to g–g are used, and a complete mapping of the ten lowest roots of the energy matrix by a continuous variation of the scale factor has been carried out within a definite range. The investigation clearly demonstrates the stabilizing ability of particular upper roots throughout the extension of the basis if the orthogonalization is properly achieved. These roots in the second-step solution may be associated with certain autoionizing states (quasi doubly-excited, discrete states). The eigenvalues, obtained by optimizing the scale factor for these roots, are compared with those obtained for resonance positions in He^+ and H elastic-scattering calculations by using other approximate methods, and by experiments. Author

N66-28055# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
EQUIVALENCE OF SPECIAL MODELS IN ENERGY-DEPENDENT NEUTRON TRANSPORT AND NON-GREY RADIATIVE TRANSFER
John C. Stewart, Ivan Kuščer, and Norman J. Mc Cormick (Loubljana Univ.) 25 May 1966 33 p refs
(JILA-72)

Mathematical equivalence is demonstrated between problems for a separable scattering kernel in energy-dependent neutron transport and for the uniform line-blanketing model of non-grey radiative transfer. As an example, the solution of the Milne problem is rederived by the method of singular eigenfunctions, with the application of orthogonality relations.
Author

N66-28066# International Centre for Theoretical Physics, Trieste (Italy).
THEORY OF CORRECTIONS TO UNITARY SYMMETRY FORMULAE
G. Furlan (Trieste Univ.), F. Lannoy, C. Rossetti (CERN), and G. Segre (Turin Univ.) Jun. 1965 29 p refs Supported in part by AFOSR
(IC-65-60) CFSTI: HC $2.00/MF $0.50

A systematic analysis of the equal time commutation relations of the generators of an algebra with certain physical operators is made. A method is then introduced whereby considering matrix elements of such commutators between physical one-particle states and using completeness and invariance under space–time translations, corrections to broken symmetry group theoretical formulas are obtained. Several applications to weak, electromagnetic, and strong interactions are then made. Author

N66-28067# Iowa State Univ. of Science and Technology, Ames.
THEORY OF MANY-BOSON SYSTEMS
Richard David Etters (Ph.D. Thesis) May 1965 42 p refs
(Contract W-7405-ENG-82)
(IS-T-19)

A many-boson theory is developed that is applicable to systems with intermediate as well as weak coupling strength. A transformation of basis from the single-particle representation to an independent collection of quasi-particles is accomplished in an approximate way. The results are in the form of coupled, nonlinear, integral equations for the ground state energy, the excitation energy, the quasi-particle excitation operator, and the momentum distribution function. No a priori assumptions concerning the population are required. Contact with the results of weak coupling theories is established by imposing additional restrictions. It is shown that the weak coupling equations are valid under more general circumstances than was previously apparent. A general theorem is provided that requires the existence of a zero in the excitation spectrum at zero momentum. It is also shown that the low lying excitations follow a dispersion rule that is linear in momentum, independent of the form of the interaction. The theory is applied to the charged boson gas problem. Author

N66-28086# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
AN APEX PROGRAM FOR THE ANALYSIS OF GAMMA-GAMMA ANGULAR CORRELATION DATA
J. L. Leigh Jan. 1966 35 p refs
(AECL-2529; CRT-1231) CFSTI: HC $2.00/MF $0.50

A program to analyze γ–γ angular correlation data from the cascade decay of aligned nuclei has been written in the APEX language for the AECL G-20 computer. Quadratic programming methods are used to determine the population parameters and multipole mixing ratios best fitting the data. Multipole contributions to the gamma rays may include dipole, quadrupole, and octupole. The mixing ratios may be defined either as the ratio of L-pole amplitude to dipole amplitude or as the ratio of L-pole amplitude to quadrupole amplitude. The program contains algorithms which search for good starting approximations to the parameters, carry out the fit, and trace the variation of χ^2 in the region of the best fit. In addition a search for a minimum in χ^2 may be initiated from any desired starting approximation. Author

N66-28101# Laboratoire de Physique Theorique et des Haute Energies, Orsay (France).
MATHEMATICAL THEORY OF NON RELATIVISTIC TWO-PARTICLE AND THREE-PARTICLE SYSTEMS WITH POINT INTERACTIONS
G. Flamand Jan. 1966 51 p refs
(TH/124) CFSTI: HC $3.00/MF $0.50

Consideration is given to point interactions in both two-body and three-body nonrelativistic particle systems. It is pointed out that while the two-body problem can be considered completely understood from both the physical and mathematical points of view, there are many questions to be answered in the case of three-body interactions. A summary of formal three-body theory is presented, the Skorniakov Ter Martirosian equation is investigated, and the asymptotic behavior of the solution of S3 for $K \to \infty$ is considered. A mathematically precise formulation of the zero range integration is included for both two- and three-body systems; and the theory of symmetric extensions of Hermitean operators in a Hilbert space is considered in detail. Point interactions are discussed as self-adjoint extensions of the free particle Hamiltonian. M.W.R.

N66-28105# European Atomic Energy Community, Geel (Belgium). Central Bureau for Nuclear Measurements.

ELASTIC SCATTERING OF NEUTRONS FROM NATURAL SILICON

M. Coppola and H.-H. Knitter Apr. 1966 15 p refs
(EUR-2798.e) CFSTI: HC $1.00/MF $0.50

Angular distributions of neutrons elastically scattered from natural Si were measured in the energy range between 0.57 and 2.28 MeV, using a fast neutron time-of-flight spectrometer. Corrections for beam attenuation and multiple scattering in the sample were performed. Differential cross section results were fitted with a Legendre polynomial expansion and the coefficients for the best fits are presented. Author

N66-28127# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.

PAPERS PRESENTED AT THE 51ST NATIONAL CONGRESS OF THE ITALIAN PHYSICAL SOCIETY, BOLOGNA, NOVEMBER 5–10, 1965 [COMMUNICAZIONI PRESENTATE DAI LABORATORI DI FISICA AL 51° CONGRESSO NAZIONALE DI FISICA 5–10 NOVEMBRE 1965]

U. Amaldi, Jr. et al 30 Oct. 1965 53 p refs In ITALIAN; ENGLISH summary
(ISS-65/40) CFSTI: HC $3.00/MF $0.50

The papers deal with the following subjects: (1) some observations about the interpretation of the measurements of the binding energies in the reactions (e,e'p) and (p, 2p); (2) angular distribution of protons in C^{12} in the reaction (e, e'p) using incident electrons with energy between 550 and 700 MeV; (3) consequences of the inelastic unitarity condition in the eigenstates of the total angular momentum; and (4) applications of unitarity conditions to the calculation of the absorptions in all the partial waves in the nucleon–nucleon scattering. Author

N66-28130# Polish Academy of Sciences, Warsaw.

CHEMICAL EFFECTS OF ELECTRIC DISCHARGES OF MILLISECOND DURATION IN A FRICKE DOSIMETER [EFEKTY CHEMICZNE MILISEKUNDOWYCH WYLADOWAN ELEKTRYCZNYCH W DOZYMETRZE FRICKE'GO]

Zbigniew P. Zagorski and Jan Grodkowski 1965 20 p refs In POLISH; ENGLISH summary
(Rept.-673/XVII/C) CFSTI: HC $1.00/MF $0.50

Millisecond electric discharges were chosen as an energy source to generate, in aqueous solutions, intermediate species similar to those occurring under ionizing radiation in a Frick dosimeter. Energy output was determined by calorimetry. The yield of iron (III) was calculated to be $G = -0.6$. Several analogies with the Frick dosimeter behavior were established. D.T.

N66-28136# Atomic Energy Establishment, Winfrith (England). General Reactor Physics Div.

CWF AND TABLE–TWO FORTRAN PROGRAMMES FOR THE CALCULATION OF COULOMB PENETRATION AND SHIFT FACTORS

D. S. Norton and M. F. James Dec. 1965 18 p refs
(AEEW-M-611) HMSO: 2s 6d

Two Fortran programs, named CWF and TABLE, were written for the IBM 7090 and English–Electric Leo Marconi KDF9 computers to calculate the penetration and shift factors for a charged particle in a Coulomb field. The numerical methods used are those of Lutz and Karvelis. It is pointed out that, in addition to the above use, CWF may be applied to the calculation of the cross sections for neutron induced reactions which result in charged particle emission. Input to CWF is in the form of neutron energy, together with the necessary reaction data; and input to TABLE is in the form of center-to-mass coordinates. D.T.

N66-28142# Atomic Energy of Canada, Ltd., Chalk River, (Ontario).

METHODS OF APPLYING COMPTON SCATTERED NEUTRON CAPTURE RADIATION TO NUCLEAR PHOTO-EXCITATION

J. W. Knowles and N. M. Ahmed 14 Mar. 1966 96 p refs
(AECL-2535) CFSTI: HC $3.00/MF $0.75

Two facilities are described which use Compton scattered (n,γ) radiation as a source of radiation of continuous energy distribution suitable for nuclear photo-excitation experiments. Using the first facility, nuclear resonance scattering of γ-radiation has been observed, between 0.8 and 6 MeV, from targets of LiF, Au and Al. Using the second facility, scattering and self-absorption measurements have been made, between 5.5 and 8.0 MeV, on targets of natural and radio-lead. Author

N66-28157# European Organization for Nuclear Research, Geneva (Switzerland). Synchro-Cyclotron Machine Div.

CONSIDERATIONS ON THE USE OF THE CERN STORAGE RINGS FOR ELECTRON–PROTON COLLISIONS

L. Goldzahl (Centre d'Etudes Nucleaires, Saclay) and E. G. Michaelis 16 Mar. 1966 14 p refs
(CERN-66-12)

The possible use of concentric storage rings for electron-proton collisions was investigated, along with the problems likely to be encountered and the physical processes which could be studied. The electron anti-damping and the Touschek effects are discussed, and it was concluded that they do not constitute fundamental difficulties. It was assumed that it will be possible to stack 10^{13} electrons, corresponding to a circulating current of 400 mA. The choice of electron energy was considered on the basis of present instruments and cost, and it is suggested that a 3 GeV electron beam would be worthwhile from the point of view of the center-of-mass energy, and cost, and complexity of the storage ring project. The electron–proton kinematics and the interaction rates were studied. It was felt that one electro-production event per minute could be expected. Recommendations for future considerations are proposed. N.E.N.

N66-28177# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf (Austria). Reaktorzentrum.

INFLUENCE OF PHOTOELECTRON STATISTICS ON TIME-CORRELATIONS IN FAST COINCIDENCE MEASUREMENTS

H. Halling, S. Mayerhofer, H. Nabilek, and E. Ujlaki 1966 26 p refs Submitted for Publication
(SGAE-PH-38/1966) CFSTI: HC $2.00/MF $0.50

Prompt curves with an exponential slope are observed in lifetime measurements of low energy γ-transitions by means of a NaI(Tl)-scintillator. In this case the statistics of electrons emitted from the photocathode determines the resulting time-correlations. These time-correlation functions are calculated on the basis of a simple statistical model. The agreement between the experimental curves and the calculations is demonstrated and a disagreement in the observed initial photoelectron rate with other experimental data is discussed. Author

N66-28188# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
QUASI-ELASTIC NEUTRINO SCATTERING ON NUCLEI
C. A. Piketty Feb. 1966 40 p refs
(TH/135) CFSTI: HC $2.00/MF $0.50

We have derived the muon angular distribution for the neutrino freon bubble chamber and the ν-spark chamber experiments. The light nuclei are described by the shell model and the heavy nucleus by the ideal Fermi gas. We have taken into account the nuclear absorption of the recoil nucleon. The nuclear parameters have been deduced from P-nucleus experiments. We have studied the validity of our approximations by comparing the experimental and theoretical differential cross sections e e' P on carbon. Despite the large experimental incertitude the equality of the axial vector form factor to the electromagnetic one seems to be favored. Finally we have given the muon angular distributions for ν-carbon scattering which will be useful for the planned ν-propane experiment. Author

N66-28198# European Organization for Nuclear Research, Geneva (Switzerland). Nuclear Physics Apparatus Div.
NEUTRINO INTERACTIONS IN THE CERN HEAVY LIQUID BUBBLE CHAMBER
C. Franzinetti 28 Mar. 1966 79 p refs Presented at the Am. Phys. Soc. Meeting, Chicago, 28 Oct. 1965
(CERN-66-13)

Results are reported for observations in a heavy liquid bubble chamber and a spark chamber following exposure to neutrino beams. The experimental procedure followed in the analysis of events is detailed, identification of the neutrino events is discussed, and neutrino and neutrino fluxes are determined. The search for the intermediate vector boson is discussed along with a hypothetical resonance, elastic interactions, conservation of the sublleptonic number, and the neutrino flip hypothesis. Elastic production of hyperons by antineutrinos, and single-pion production are described; and consideration is given to Adler's test of the partially conserved axial current hypothesis. M.W.R.

N66-28201# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
THEORETICAL PROFILES OF THE SPECTRAL LINES OF THE HYDROGEN ATOM [PROFILS THEORIQUES DES RAIES SPECTRALES DE L'ATOME D'HYDROGENE
H. Nguyen, L. Herman (Lab. de Rech. Phys., Sorbonne, Paris), and H.-W. Drawin Brussels, EURATOM, May 1966 56 p refs In FRENCH; ENGLISH summary
(Contract EURATOM-007-62-1 FUAF)
(EUR-2830.f; CEA-R-2912) CFSTI: HC $3.00/MF $0.50

The line-broadening problem of the hydrogen lines has been formulated in the quasi-state approximation as far as the ions are concerned, and in the classical path approximation as far as the broadening due to collisions with electrons is concerned. These electrons interfere in different numerical results only by the self-correlation function of the fluctuating electrical field strength created at each point in the plasma. The Lewis correction has been applied, but using the whole velocity distribution function of the electrons. The formula which represents the usual impact profile, valid only for frequencies much smaller than the plasma frequency, has been extended using another formula which will be valid up to the neighborhood of that spectral region where the quasi-static approximation begins to be valid also for the electrons. As an example, the line profile of Lyα is given by some graphs for $T = 10^{4\circ}$ K and electron densities $N = 10^{17}$ cm^{-3} and $N = 10^{18}$ cm^{-3}. Author

N66-28202# Nihon Univ., Tokyo (Japan). Dept. of Physics.
THE INTERMEDIATE BOSON THEORY OF THE WEAK INTERACTIONS
Seitaro Nakamura [1965] 56 p refs Presented at the Intern. Conf. on Elementary Particles, Kyoto, 1965
CFSTI: HC $3.00/MF $0.50

The recent investigations on the theory of the intermediate bosons are briefly reviewed. The possible contributions of the intermediate boson processes in the two-faced coupling scheme to the high energy weak interactions as well as to the low energy weak interactions are evaluated, and compared with the experiments. As an extension of the 'meso-strong' interaction a new interaction between pion and baryons is introduced which is axial symmetric in the isotopic spin space. A number of the results are derived on the nuclear force, the matrix elements of beta decay, and the decay of particles in the rare modes. Author

N66-28206# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf (Austria). Reaktorzentrum.
MEASUREMENTS OF THE Pb-210 SHELL STRUCTURE WITH HARMONIC OSCILLATOR WAVE FUNCTIONS [Pb-210, SCHALENMODELLRECHNUNGEN MIT HARMONISCHEN OSZILLATORWELLENFUNKTIONEN]
Gerhard Hertenberger, Gerda Steinbach and Heinrich V. Geramb 1966 14 p refs In GERMAN Submitted for Publication
(SGAE-PH-37/1966) CFSTI: HC $1.00/MF $0.50

The dependence of the energy level breakdown for 0+, 2+, 4+, 6+, on configuration mixture, potential form, and potential parameter for singlet and triplet potential depths is shown. Proceeding from the nucleus Pb 208, the disturbance theory was applied for the two neutron holes of Pb 206 by the method of the harmonic oscillator wave function. Similar calculations for Pb 210 with two valence neutrons, resulted in qualitative confirmation up to 50 keV with previously identified levels. Transl. by K.W.

N66-28210# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
THE SPECTRAL DISTRIBUTION OF PHOTONS SCATTERED BY ELECTRONS BOUND IN THE K SHELL, III [DISTRIBUZIONE SPETTRALE DI FOTONI DIFFUSI DA ELETTRONI LEGATI NELLA SHELL K, III]
M. A. Di Lazzaro and G. Missoni 21 Feb. 1966 40 p refs
(ISS-66/8) CFSTI: HC $2.00/MF $0.50

A detailed description of a set of measurements to find the spectral distribution of 662 keV γ-rays scattered by K shell electrons of gold and uranium is reported. The spectral distribution of spurious events owing to bremsstrahlung inside the target is also presented and compared with theoretical

values. Experimental results pertaining to the spectral distributuion of photons scattered by K shell electrons are compared with theoretical values obtained, by different approximations, from the Klein–Nishina formula. Such values do not agree with experimental data. Another calculation of the differential cross-section for the scattering by bound electrons in which the initial state of the bound electron is described by a Dirac wave function in a Coulombian field is also presented. Results of this calculation are in fair agreement with experimental data. Author

N66-28211# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Servizio Documentazione.
SINGLE BOSON PRODUCTION IN ADONE
B. Bartoli, C. Bernardini, F. Felicetti, V. Silvestrini, F. Vanoli (Naples Univ.) et al 30 Mar. 1966 19 p refs *Its* Nota Interna No. 315
(LNF-66/16) CFSTI: HC $1.00/MF $0.50

A discussion of how single bosons produced in e^+e^- collisions can be investigated by the Adone mass spectrometer is presented. The production cross section is peaked around the boson mass, and reproduces the line shape characteristic of a free unstable particle as a function of the total center of the primaries total center of mass energy. Thus, a plot of the counting rate versus total c.m. energy of the colliding e^+e^- should exhibit a line structure over a flat nonresonant background. A storage ring can be used in this sense as a boson mass spectrometer. Discussed are (1) the experimental setup, (2) a fast method to explore the whole mass range, (3) counting rate estimates, (4) backgrounds, and (5) a criterion for the evidence of a peak. Data for known resonances are given. A possible scheme of the electronics involved for the measurements is depicted. L.S.

N66-28212# Laboratorie de Physique Theorique et des Hautes Energies, Orsay (France).
STRONG INTERACTION CORRECTIONS TO COULOMB COHERENT PRODUCTION OF ρ BY π ON NUCLEI
J. P. Leroy Apr. 1966 18 p refs
(TH/144) CFSTI: HC $1.00/MF $0.50

The one-pion exchange contribution to ρ production by π on nuclei is computed by means of a modified pion propagator through nuclear matter and compared to the coulombian production. Author

N66-28221# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
THE SPECTRAL DISTRIBUTION OF PHOTONS SCATTERED BY ELECTRONS BOUND IN THE K SHELL, I [DISTRIBUZIONE SPETTRALE DI FOTONI DIFFUSI DA ELETTRONI LEGATI NELLA SHELL K, I]
M. A. Di Lazzaro and G. Missoni 21 Feb. 1966 44 p ref For abstract see N66-28210 15-24
(ISS-66/6) CFSTI: HC $2.00/MF $0.50

N66-28235# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
SUM RULES FOR COMPTON SCATTERING, I
M. Gourdin 2 May 1966 59 p refs
(TH/146) CFSTI: HC $3.00/MF $0.50

This paper presents an extension of Fubini's results to the more complicated case where spin 1/2 particles are involved and completes the set of sum rules by a trivial extension of Adler's work to nonforward transitions. A short presentation of the Fubini and Adler methods is given. The problem of evaluating an equal time commutator of current components is examined and an assumption referring to the quark model is made. The fundamental equalities from which the sum rules follow are written after expanding the various amplitudes on a convenient basis. The general sum rules are obtained by summing unsubtracted dispersion relations and high energy behavior for some scalar amplitudes. The particular case of Compton scattering on nucleons with a virtual or a real photon is examined. The connection between the Compton scattering sum rules and the Adler sum rules is given. The appendices include the numbers of independent amplitudes, the gauge invariance and the time reversal invariance requirements on the Compton scattering amplitudes, the residue of the Born approximation of Compton scattering, the connection with the Cabibbo–Radicati sum rules on photoproduction, and the general sum rules for Compton scattering on pions. R.N.A.

N66-28272# Carnegie Inst. of Tech., Pittsburgh, Pa. Dept. of Physics.
A STUDY OF THE HARTREE–FOCK APPROXIMATION AS APPLIED TO FINITE NUCLEI
K. T. R. Davies (Oak Ridge Natl. Lab.), S. J. Krieger, and M. Baranger Mar. 1966 50 p refs Submitted for Publication (Contract Nonr-760(15))
(TR-23; AD-631231) CFSTI: HC $4.60/MF $0.50

Hartree–Fock calculations have been performed for the closed-shell nuclei ^{16}O, ^{40}Ca, ^{80}Zr, and, with certain simple approximations, for the open-shell nuclei ^{12}C, ^{28}Si, and ^{60}Zn. The velocity dependent two-body force acts in relative s-states only. The force saturates nuclear matter at the correct energy and density and yields small second order perturbation corrections, but has too large a range to be in good agreement with the two-body data. However the choice of this simple force enables us to study the Hartree–Fock approximation in detail which is the main purpose of this paper. The authors calculate wave functions, energy levels, binding energies, and density distributions for the six nuclei and obtain rough agreement with the experimental results. A discussion is given of the non-local Hartree–Fock potential. Author (TAB)

N66-28281# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LABORATORY AND DEMONSTRATION HEAVY-PARTICLE ACCELERATORS
G. I. Kuz'menko 13 Apr. 1966 8 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Fiz. (Tomsk), no. 4, 1965 p 174–175
(FTD-TT-66-191/1+2+4; AD-631586) CFSTI: HC $1.10/MF $0.50

Proton Accelerator-Discharger: The proton tube with a lithium target makes possible checking the relationship $E=mc^2$ by measuring the scattering of alpha particles in the nuclear reaction between lithium and hydrogen to give helium. The identification of alpha particles with the aid of a scintillation counter is accomplished by fixing a sharp drop in the impulses as a result of drawing the counter away from the cathode. Deuterium Accelerator-Discharger: An aluminum anode, a deuterium target, and heavy water are used. A flux of hydrogen nuclei is obtained to bombard the cathode. The neutrons obtained should be counted by a scintillation counter. TAB

N66-28294# Yale Univ., New Haven, Conn. Gibbs Lab.
[ATOMIC BEAM SOURCE OF POLARIZED ELECTRONS AND HELIUM-PROTON MAGNETIC RESONANCE RATIO]

Annual Summary Report, 1 Jan. 1965–31 Mar. 1966
Vernon W. Hughes Mar. 1966 10 p refs
(Contract Nonr-609(53))
(AD-631303) CFSTI: HC $1.00/MF $0.50

ATOMIC BEAM SOURCE OF POLARIZED ELECTRONS: (1) Large depolarization effect in potassium beam experiments: Non-adiabatic transitions and collisions with gas molecules were proven not responsible for polarization observed after elimination of potassium molecules. The following effects were responsible: insufficient energy discrimination in the Mott scattering apparatus and the overlap by the strong line of the high-pressure mercury arc on the wavelength of the second resonance transition in potassium. (2) Higher intensity source of polarized electrons: a pulsed light source and a lithium atomic beam were selected for improving the source of polarized electrons. (3) A high-pressure-spark light source was built as a source of polarized electrons. MAGNETIC RESONANCE: Precision measurement was made of the ratio of the nuclear magnetic moment of He-3 to that of the proton. TAB

N66-28309# Syracuse Univ., N. Y.
AN EXPERIMENTALIST'S VIEW OF SU_3
Jack Leitner [1966] 37 p
(Contract Nonr-669(12))
(ONR-66-1; AD-631704) CFSTI: HC $2.00/MF $0.50

A general review of the extent of the agreement between SU_3 and experiment is presented. It is stated that some confusion exists between those who emphasize the apparent successes of this theory and those who point out its apparent failures. One of the reasons given for this state of confusion is that SU_3 is a theory of approximate symmetry where the strong hamiltonian is not entirely invariant under appropriate transformations. It is pointed out that the organization of the catalog of SU_3 is a compromise between logical development and historical emphasis. This catalog includes: classification of mesons and baryons, electromagnetic properties of baryons and mesons, production rates of baryons and mesons, leptonic weak interactions, and non-leptonic decays. A discussion of each of these considerations is included. H.S.W.

N66-28316# Naval Radiological Defense Lab., San Francisco, Calif.
BETA ENERGY EMISSION RATE FROM NEUTRON-IRRADIATED, URANIUM-235-CARBIDE PARTICLES
James F. Pestaner and Richard Yakiku 11 Jan. 1966 17 p refs
(Contract AT (49-2)-2505)2))
(USNRDL-TR-987; AD-631198) CFSTI: HC $1.00/MF $0.50

The beta energy emission rate from neutron-irradiated, uranium-235-carbide particles was measured by chemical dosimetry. The particles were suspended by vigorous stirring in ferrous sulfate solutions. The oxidation of ferrous to ferric ion was the chemical change measured, this change being related to the energy absorbed by the solution. Good agreement was obtained between the existing calculated and the experimental values of beta energy emission rate. From these data, simplified equations were derived for calculating beta energy emission rate as a function of particle size and time after fission, and they are presented. Author (TAB)

N66-28347# Rochester Univ., N. Y. Dept. of Physics and Astronomy.
SOME APPLICATIONS OF THE ALGEBRA OF CURRENTS
L. K. Pandit 7 Feb. 1966 22 p refs Presented at the Third Coral Gables Conf. on Symmetry Principles, Miami Univ., 19–21 Jan. 1966
(Contract AT(30-1)-875)
(UR-875-121) CFSTI: HC $2.00/MF $0.50

Various applications of the algebra of currents theory are briefly discussed. In particular, $k\pi$ interactions, decays of vector mesons, and the evaluation of anomalous magnetic moments are discussed. NSA

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N66-27061# General Motors Corp., Indianapolis, Ind. Allison Div.
PLASMA PROPERTIES BY SPECTROSCOPIC MEASUREMENTS
H. D. Wilsted and Wolfgang Woerner *In its* Allison Res. and Eng., Vol. No. 9 1966 p 2–17 refs (See N66-27060 15-34)

Spectrographic measurements of plasma properties in direct conversion devices and a cesiated helium arc have been made and a summary of these studies is presented herein. The line reversal technique was used to measure the electron temperature in a magnetoplasmadynamic (MPD) generator and appeared to give good results; accuracies should be within ±75°K. Both the absolute intensity and relative line intensity methods were used to measure electron temperature in a thermionic generator. Author

N66-27087# Los Alamos Scientific Lab., N. Mex.
SPHERICAL HARMONIC REDUCTION OF THE FOKKER-PLANCK EQUATION
Thomas A. Oliphant, Jr. Aug. 1965 45 p refs
(Contract W-7405-ENG-36)
(LA-3437) CFSTI: HC $2.00/MF $0.50

The Fokker–Planck equation is reduced to a form that is useful from the viewpoint of doing practical calculations of problems involving configuration space as well as velocity space. The basic technique is a spherical harmonic decomposition in velocity space that reduces the number of independent variables by two. As an example, the application of the method to a problem with theta-pinch geometry is outlined. Author (NSA)

N66-27095# Oak Ridge National Lab., Tenn.
THERMONUCLEAR DIVISION Semiannual Progress Report, Period Ending 31 Oct. 1965
A. H. Snell et al Mar. 1966 188 p refs
(Contract W-7405-ENG-26)
(ORNL-3908) CFSTI: HC $5.00/MF $1.00

Progress in thermonuclear research is reported in the following areas: single and multiple pass experiments (DCX-1 and DCX-2) in injection and accumulation; electron-cyclotron heating; plasma physics; atomic and nuclear cross sections; high-current ion-beam production and injection; plasma theory and computation; magnetics and superconductivity; and vacuum studies, sputtering, adsorption, and diffusion of gases in metals. C.T.C.

N66-27123# Princeton Univ., N. J. Plasma Physics Lab.
ON THE KINETIC STRUCTURE OF A PLASMA
John M. Dawson and Toshio Nakayama Jan. 1966 48 p refs
(Contract AT(30-1)-1238)
(MATT-395)

The kinetics of a plasma is investigated by expanding the motion in terms of the deflection of the particles from their noninteracting orbits. It is shown that this procedure leads to the following results. At the first stage, the dressed-particle picture of Thompson and Hubbard, and of Restoker for obtaining fluctuations in a plasma is obtained. Rostoker's principle for obtaining two-particle correlations in terms of test particle results is also obtained at this state. At the second stage, encounters between shielded particles appear and the picture of Birmingham, Dawson, and Oberman for computing bremsstrahlung energies. The usual Fokker–Planck equation may also be obtained at this stage. The treatment applies to the full electromagnetic field.
Author (NSA)

N66-27127# California Univ., Livermore. Lawrence Radiation Lab.
CONTROLLED THERMONUCLEAR RESEARCH Semiannual Report, Jan.–Jun. 1965
[1965] 147 p refs
(Contract W-7405-ENG-48)
(UCRL-14285) CFSTI: HC $4.00/MF $1.00

A summary is presented of thermonuclear studies in magnetic mirror machines, Astron devices, and various other machines having a toroidal configuration; and plasma studies of a theoretical, experimental, and engineering nature. The particular machines studied include Table Top III, Alice, Astron, Levitron, Homopolar Gun I, Homopolar V, and others. NSA

N66-27128# Princeton Univ., N. J. Plasma Physics Lab.
ON THE INITIAL TRANSIENT OF A THERMONUCLEAR REACTOR
Robert G. Mills Mar. 1966 32 p refs
(Contract AT(30-1)-1238)
(MATT-437) CFSTI: HC $2.00/MF $0.50

During the period when a thermonuclear reactor is brought into operation, the temperatures and densities of the components of the plasma undergo significant changes. The period of time is of interest since it bears on the possibility of establishing the steady state conditions necessary for a successful reactor. The history of a thermonuclear plasma is traced during its first milliseconds of development. Author (NSA)

N66-27145# United Kingdom Atomic Energy Authority, Culham (England).
OSCILLATIONS AND INSTABILITY OF A WEAKLY TURBULENT PLASMA
A. A. Vedenov, A. V. Gordeev, and L. I. Rudakov Sep. 1965 23 p refs Transl. into ENGLISH from Russian Paper CN-21/155 Presented at Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Culham, England, 6–10 Sep. 1965
(NP-TR-1348) CFSTI: HC $1.00/MF $0.50

The possibility is discussed of describing effects associated with the interaction of collective oscillations of a plasma by means of a self-consistent system of equations: a kinetic equation for the distribution function of high-frequency waves (in six-dimensional coordinate- and wave-vector space) and equations describing the slow motion of a plasma under the action of high-frequency pressure. NSA

N66-27146# California Univ., Livermore. Lawrence Radiation Lab.
PROCEEDINGS OF THE 1965 SYMPOSIUM ON ENGINEERING PROBLEMS OF CONTROLLED THERMONUCLEAR RESEARCH
[1965] 271 p refs Symp. held 4–7 May 1965; sponsored by Lawrence Radiation Lab., Livermore, Calif. Abstracts of papers previously published as UCRL-14120
(Contract W-7405-ENG-48)
(CONF-650512; UCRL-14120) CFSTI: HC $6.00/MF $1.25

Symposium papers on vacuum systems, energy storage systems and components, diagnostic instruments, magnetic fields, special materials and power supplies, and other aspects of fusion research are presented. For individual titles see N66-27147–N66-27179.

N66-27147# Oak Ridge National Lab., Tenn.
PRODUCTION OF 10^{-9} TORR WITHIN A LARGE PLASMA CONTAINER (DCX-1)
E. R. Wells *In* Calif. Univ. Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res. [1965] p 1–6 refs (See N66-27146 15-25)

This paper briefly describes the DCX-1 vacuum system, methods and techniques of operation, and some of the diagnostic equipment. Operating pressures of 10^{-9} torr are readily obtained in a large stainless steel three-region system of 150 cu ft volume. The outer shell of the system makes use of many elastomer seals to permit quick alterations of experimental apparatus. The inside walls of the tank are shielded with copper which can be baked at 400°C or cooled to 77°K. With the use of electron bombardment and evaporated titanium the pressure in this region is reduced to 3×10^{-9} torr. The liner or innermost volume is a copper cylinder of 150 liters volume which is baked at 400°C and cooled to 77°K. Through the use of titanium pumping and temperature recycling, operating pressures of 10^{-9} are obtained with ultimate pressures of 4×10^{-10} torr. It is possible to cycle the temperature on the shields and the liner from liquid nitrogen to 400°C in less than 1 hr, thereby keeping down time on the machine to a minimum. Some of the diagnostic equipment, including energy analyzers, neutral particle detectors, radio-frequency antennas, and gas analyzers, are discussed with emphasis on methods of fabrication and results obtained.
Author

N66-27152# Oak Ridge National Lab., Tenn.
THE PRODUCTION OF "EXCITED STATE" H^+_2 FOR LORENTZ DISSOCIATION IN DCX-1
R. W. Edwards *In* Calif. Univ. Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res. [1965] p 27–30 refs (See N66-27146 15-25) CFSTI: HC $6.00/MF $1.25

This paper gives the details of obtaining an H^+_2 beam in excited states from H^+_2 produced in a duoplasmatron ion source. The beam is used for Lorentz dissociation to create a 300-keV plasma within DCX-1. The optimum source conditions necessary to extract large H^+_3 currents from duoplasmatrons, the electrostatic method used to neutralize these large currents to obtain parallel beams over long distances, the construction of a water vapor conversion cell, and the remaining ion optics are all discussed in detail. The source has so far produced over 800 uA of H^+_2 in the excited states from 8 mA of H^+_3. This is equivalent to an input of 800 mA of H^+_2 obtained in the conventional extraction schemes.
Author

N66-27153# General Electric Co., Schenectady, N. Y. Research Lab.
SUSTAINED-FIELD THETA PINCH

W. F. Westendorp *In* Calif. Univ. Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res. [1965] p 31–34 (See N66-27146 15-25) CFSTI: HC $6.00/MF $1.25

The purpose of the sustained-field theta pinch is the study of containment of a high temperature plasma for times that are long compared to the usual natural period of a theta pinch system, i.e., longer than 20 μsec and possibly as long as several milliseconds. We first produce a long-duration field pulse in a low frequency circuit that contains the pinch coil. When this field has reached its maximum, we superimpose a buckling high-frequency field that first reduces the net field to zero, then reverses it to a negative value, subsequently allowing it to pass through zero again and return to the original positive value. A theta pinch oil was designed to withstand a long-duration magnetic pressure of 1500 psi, and a low frequency transformer for a pulse of 1 million amperes peak at 400 V without iron core. Streak camera pictures showed that, during preionization at the time of negative field, too much negative field got trapped in the plasma and a highly unstable plasma of not more than 20 μsec duration resulted. To keep the field from going strongly negative, a highly damped third circuit was installed to produce a short pulse to cancel the negative field and maintain essentially zero net current in the pinch coil for several microseconds. Author

N66-27154# Stevens Inst. of Tech., Hoboken, N. J.
THE CHALICE FAST, HIGH-VOLTAGE PLASMA BANK
G. J. Yevick, G. von Voros, H. Opat, H. Nyland, and R. Southworth *In* Calif. Univ. Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res. [1965] p 35–43 refs Sponsored by AEC (See N66-27146 15-25) CFSTI: HC $6.00/MF $1.25

Some new features in the design and construction of a fast 80-kJ, 50-kV main bank for Chalice Mark II are discussed. The operating characteristics and performance of this bank are now being tested. The bank is divided into two halves, each comprising 32 μF capacitance. We have measured the ringing frequency of the shorted bank and have found it to be around 550 kc, yielding a value of around 3 nH for the inductance of the shorted bank plus switch. Low inductance is achieved by the use of parallel plate transmission lines and collector plates. The solution to the difficult problem of high frequency corona is discussed. In the design of very low inductance series and crowbar switches, we use the rupturing of a dielectric by exploding wires. Here the problems are very low inductance, simultaneity of closing, very low resistance, and no damage. Multiple parallel channels minimize the arc damage and lower the inductance. The bank will be used for the study of stability and loss of plasma through the line escape in a cusp magnetic field. Author

N66-27156# Naval Research Lab., Washington, D. C.
PHAROS CROWBAR SYSTEM
M. P. Young *In* Calif. Univ. Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res. [1965] p 57–62 refs (See N66-27146 15-25) CFSTI: HC $6.00/MF $1.25

The circuit parameters, voltage and current waveforms, design, and operation of a switch clamp system used for the Pharos magnetic compression experiment, are discussed. Clamping the circuit at the current maximum converts the normal damped oscillatory waveform to an exponential decay, thus increasing the duration of the effective magnetic field to about 180 μsec. Important features of the clamp circuit design for the switches are outlined. The clamp switches are a variation of an air trigatron starting switch. Described are the tungsten–copper electrodes, the housing, the expansion chamber assembly, and the trigger pin assemblies. The terminals, which are an integral part of the electrodes, allow direct mounting across the condenser high-voltage stud and ground plate. Life tests on 7 prototype switches showed a reliable life of >4000 discharges at 5 kJ per switch. L.S.

N66-27160# General Dynamics Corp., San Diego, Calif. General Atomic Div.
A METHOD OF USING A COMPUTER TO EVALUATE LANGMUIR PROBE DATA FOR OBTAINING THE ELECTRON TEMPERATURE
G. H. Eggers and F. Schwirzke *In* Calif. Univ. Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res. [1965] p 96–09 (See N66-27146 15-25) CFSTI: HC $6.00/MF $1.25

In studying diffusion the electron temperature of a plasma is usually measured by Langmuir probes as a function of radius, magnetic field, pressure, etc. It has been demonstrated that if the probe potential is close to the floating potential, one may have confidence in probe characteristics as a means of determining the electron temperature in a strong magnetic field. However, the portion of the characteristic of interest is usually close to zero current. This fact causes severe problems in direct logging methods. Therefore, data is taken with a linear instrument and the logarithm is determined by manual plotting. The number of characteristics that must be evaluated for an experiment may be as many as several hundred. It is apparent that manual evaluation is laborious, inaccurate, and expensive. This problem can be alleviated by converting the data to binary-coded decimal form and using a computer to process it. The computer is then programmed to give the electron temperature directly. Two alternatives for conversion of data to binary-coded decimal form are discussed. Author

N66-27161# Princeton Univ., N. J. Plasma Physics Lab.
HIGH-ACCURACY MEASUREMENTS OF LARGE dc PULSE CURRENTS
J. W. Spinner *In* Calif. Univ. Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res. [1965] p 100–104 (See N66-27146 15-25) CFSTI: HC $6.00/MF $1.25
(Contract AT(30-1)-1238)

A current-metering system has been developed to measure the magnetic field strength of the confining field in the C Stellarator to an accuracy of ±0.1%. At present the field current is pulsed to 36,000 A for 1 sec once every 40 sec. The maximum allowable current is 44,600 A. Measurement of the pulse current at any point in the waveform is accomplished by measuring the voltage drop of a metering shunt. This signal is amplified and sampled by an A/D converter. The system floats at ±400 V to ground and is isolated to withstand a ±5-kV fault voltage to ground. The reading is displayed on a remote decimal readout and transmitted to an IBM card punch. Since the load has a time constant of 1 sec, the sampling time is shorter than 1 msec to meet the accuracy requirements when maximum rate of change of the current occurs. During the pulse, the experimentalist may choose any specific time to measure the current. Field measurements have determined that the linearity of the system is ±0.05%, and additional systems are being fabricated which will provide verification of the present system accuracy. Author

N66-27163# California Univ., Livermore. Lawrence Radiation Lab.
A METHOD FOR THE CONTINUOUS MEASUREMENT OF PLASMA POTENTIAL USING A CONSTANT-CURRENT, LITHIUM-ION-BEAM TRANSMISSION TECHNIQUE

A. F. Waugh and G. G. North *In its* Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res. [1965] p 109–111 refs (See N66-27146 15-25) CFSTI: HC $6.00/MF $1.25

A method is described for continuously measuring a positive plasma potential over the range from 100 V to 5 kV. The time resolution of the measurement is approximately 0.5 msec. A constant-current regulator system is used to vary the energy of thermionically emitted lithium ions so that a preselected lithium ion current level is maintained through a mirror-field-confined plasma region into a Faraday collector cup. This method results in the energy of the lithium ions (applied accelerating voltage) being held equal to the instantaneous value of the varying plasma potential (net voltage of the confined plasma with respect to ground). Therefore, monitoring the voltage to the lithium ion source is effectively monitoring the plasma potential. Author

N66-27166# Princeton Univ., N. J. Plasma Physics Lab.
SOME USEFUL TECHNIQUES IN THE DESIGN OF MULTIPOLAR WINDINGS IN CLOSED SYSTEMS
Kenneth E. Wakefield *In* Calif. Univ. Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res [1965] p 128–130 (See N66-27146 15-25) CFSTI: HC $6.00/MF $1.25 (Contract AT(30-1)-1238)

This paper presents magnetic and mechanical design techniques which should be useful in developing many of the multipolar windings now being considered throughout the world. Described are magnetic design procedures and related computer programs which ensure that the spatial arrangement of the conductors will achieve the purposes of the configuration, which are usually expressed in terms of certain magnetic field parameters. Problems encountered in devising conductor arrangements producing these beneficial effects are discussed, and ways in which one might resolve these problems are presented. Details of novel design concepts are also given. Author

N66-27169# California Univ., Livermore. Lawrence Radiation Lab.
BEAM INFLECTORS FOR THE ASTRON MACHINE
James F. Ryan *In its* Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res. [1965] p 142–145 refs (See N66-27146 15-25) CFSTI: HC $6.00/MF $1.25

Design and construction methods are given for two types of beam inflectors used to take the external electron beam through the main magnetic field and into the confinement chamber of the Astron machine. One inflector uses five concentric tubular conductors with sinusoidal current distribution to cancel the prevailing main field inside the inflector without perturbing it outside. The other uses a central tube of high permeability and a single tubular conductor with sinusoidal current distribution to correct the perturbation in the external field caused by the permeable tube. The average remaining field inside the inflector is only 0.4% and 0.1%, respectively, for the two types. Both inflectors use diverted turns of the main solenoidal field coils to power the canceling or correcting fields. A method is given for producing sinusoidal current sheets by electroforming and ordinary lathe work. Author

N66-27170# Oak Ridge National Lab., Tenn.
DCX-2 BEAM-INJECTION DUCT
R. L. Brown, P. R. Bell, and J. S. Culver *In* Calif. Univ. Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res. [1965] p 146–151 refs (See N66-27146 15-25) CFSTI: HC $6.00/MF $1.25

The magnetically shielded duct (snout) through which the molecular ion beam is injected into DCX-2 has the rather severe requirement that it shield the internal channel from an external magnetic field of 12 kG while disturbing the very uniform external field to a negligible degree. Engineering aspects of the latest model snout are presented. Author

N66-27178# Princeton Univ., N. J. Plasma Physics Lab.
HIGH-Q CAPACITOR DEVELOPMENT
N. W. Mather *In* Calif. Univ. Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res. [1965] p 201–212 refs (See N66-27146 15-25) CFSTI: HC $6.00/MF $1.25 (Contract AT(30-1)-1238)

Failure tests were conducted on energy storage capacitors having high Q in an effort to develop high Q capacitors suitable for use in rf circuitry for a pulsed, low-frequency magnetic pumping system (to be used for plasma heating experiments on a model C Stellarator). It was noted that the kind of switching used in the test circuitry of the capacitors had a very marked influence on capacitor life. It was concluded that high frequency transients associated with fast switching (and involving stray circuit parameters) were involved in previous failures. Specifications for prototype units were drawn up; units were fabricated by several different manufacturers; and units from three of the manufacturers passed initial testing. The units were assembled in groups and are now being failure tested. The Q of the assemblies ranges from about 400 to 500. Thus far Q's of 135 at 52 kc and 102 at 90 kc were achieved. L.S.

N66-27179# Princeton Univ., N. J. Plasma Physics Lab.
ENERGY SUPPLY FOR A HIGH-POWER, PULSED, LOW-FREQUENCY RF GENERATOR
N. W. Turitzin *In* Calif. Univ. Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res. [1965] p 213–220 (See N66-27146 15-25) CFSTI: HC $6.00/MF $1.25

This paper describes the design of an energy storage supply of 1.6 MJ capacity, arranged as a pulse forming network and capable of delivering a dc pulse of about 2800A at 50kV for 10 msec duration once every 30 sec. Problems discussed include transient suppression, false firing of ignitron switches, suppression of voltage overshoot at the load because of pulsing, arrangement of crowbars for load protection and reduction of oscillations within the pulse forming network caused by crowbarring, limitation of length of the output pulse, filtering of voltage fluctuations because of class B operation of supply load, and glow discharge behavior of ignitron switches. Author

N66-27196*# National Aeronautics and Space Administration, Washington, D. C.
SOME FEATURES OF THE TRANSVERSE PROPAGATION OF HIGH FREQUENCY WAVES IN A MAGNETOACTIVE PLASMA [O NEKOTORYKH OSOBENNOSTYAKH POPERECHNOGO RASPROSTRANENIYA VYSOKOCHASTOTOCHNYKH VOLN V MAGNITOAKTIVNOY PLASME]
B. N. Gershman Jun. 1961 10 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 137, no. 4, 1961 p 822–825
(NASA-TT-F-8019) CFSTI: HC $1.00/MF $0.50 CSCL 20I

In analyzing the propagation of transverse high-frequency waves, the author questions the validity of previous conclusions. Particular doubt is expressed with regard to results reported by E. P. Gross who, using the nonrelativistic approach, showed that during the propagation of a plasma wave narrow zones appear in the plasma. Inside these zones no propagation takes place at frequencies near the electron gyrofrequency ω_H or near $2\omega_{H.O}$, $3\omega_{H.O}$, etc. For an accurate analysis of the problem, it is suggested that the results obtained through the nonrelativistic approach be corrected to account for the relativistic dependence of electron mass on electron thermal velocity. Author

N66-27203*# Consultants and Designers, Inc., Arlington, Va.
THEORY OF STATIONARY PROPERTIES OF A FULLY-IONIZED CIRCUMTERRESTRIAL PLASMA [TEORIYA STATSIONARNYKH SVOSTV POLNOST'YU IONIZIROVANNO OKOLOZEMNOY PLAZMY]
A. A. Vlasov and F. Kh. Khakimov 18 Sep. 1963 8 p Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Fiz. (Moscow), v. 151, no. 4, Aug. 1963 p 819–821
(Contract NAS5-2078)
(NASA-TT-F-8630; ST-PF-10049) CFSTI: HC $1.00/MF $0.50 CSCL 20I

A theory of stationary properties of a fully ionized circumterrestrial plasma is proposed. This theory takes into account: (1) the ellipsoidicity of the distribution functions of electrons and nuclei at great heights; (2) the reactions of this distribution upon the action of the outer (dipole) magnetic field of the earth; and (3) the interaction of charged particles among themselves and with the aggregate charge of the earth and of the atmosphere. I.v.L.

N66-27315*# AVCO-Everett Research Lab., Everett, Mass.
STUDY OF MAGNETIC ANNULAR PLASMA ACCELERATOR Summary Report, 15 Apr. 1964–14 Jan. 1966
R. M. Patrick and A. M. Schneiderman [1966] 126 p refs
(Contract NAS3-5748)
(NASA-CR-54686) CFSTI: HC $4.00/MF $1.00 CSCL 20I

Experimental and analytical studies were conducted to obtain high propulsive efficiencies in the 2000–3500 sec specific impulse range with a magnetic annular arc (Maarc). An axisymmetric geometry was chosen, consisting of a central cathode and an axisymmetric anode surrounded by a solenoidal magnetic field. Local diagnostic techniques used to calculate density and velocity profiles are described. The voltage characteristics of the device with various propellants and bias field intensities were investigated; it was found that the voltage is linearly dependent on the intensity and is a function of the propellant and the B field geometry. Thrust profile measurements show that both the magnitude of the total thrust and the thrust density profile are very sensitive to the magnetic field intensity and shape. Local mass flow distributions, measured in the plasma jet, indicate that the ambient tank gas mixes with the plasma issuing from the Maarc nozzle. Axial and radial current distribution in the plasma flow was also measured. Results indicate that the Maarc is capable of producing a steady axisymmetric discharge in such propellants as nitrogen, hydrogen, ammonia, helium, and argon at power levels from 10 to 200 kw. M.G.J.

N66-27336# Comitato Nazionale per l'Energie Nucleare, Rome (Italy).
THE DIRECT CONVERSION OF THERMAL ENERGY IN THE MAGNETOPLASMADYNAMIC POWER GENERATION PROGRAM AT C.N.E.N. [LA CONVERSIONE DIRETTA DELL' ENERGIA TERMICA IN ENERGIA ELECTTRICA PER VIA MAGNETO-PLASMA-DINAMICA PROGRAMMA DEL C.N.E.N.]
E. Bertolini, A. Boschi, C. Lo Surdo, and R. Toschi Sep. 1965 46 p refs In ITALIAN
(RT/FI(65)31)

The research program on Magnetoplasmadynamic (MPD) Power Generation to be carried out under the auspices of C.N.E.N. during the period 1965–1969 is outlined. The general features and the state of art of MPD systems in closed cycle are reported. The main object of the theoretical and experimental work to be done during the first two and half years, is the study of the ionization processes in a MPD generator using an alkali seeded noble gas. The two main experiments, a high speed moving plasma and a steady plasma in a generator duct, are described together with the diagnostic techniques. Author (NSA)

N66-27337# California Univ., Berkeley. Lawrence Radiation Lab.
USE OF THE BETHE-SALPETER EQUATION IN TRANSPORT THEORY AND THE DERIVATION OF A CONVERGENT KINETIC EQUATION FOR A CLASSICAL PLASMA
Harvey Allen Gould (Ph.D. Thesis) 23 Nov. 1965 161 p refs
(Contract W-7405-ENG-48)
(UCRL-16557) CFSTI: HC $5.00/MF $1.00

The response of a normal many-body system to a weak external electric field is expressed in terms of the change in the one-particle distribution function. The basis of the treatment is the relation between the response and an appropriately defined two-particle Green's function. Making extensive use of the temperature-dependent diagram technique and the method of analytic continuation, a general transport equation valid for low frequencies and long wavelengths is derived. The derivation is based on a reordering of the perturbation expansion of the two-particle Green's function leading to the formulation of the temperature-dependent Bethe–Salpeter equation. Full advantage is taken of the analytic properties of G_2. The collision integral involves the imaginary part of the self-energy and various discontinuities of the kernel of the Bethe–Salpeter equation. The general transport equation is used to derive a kinetic equation for the electron gas not subject to the usual short-range divergence and is exact to first-order in the plasma parameter. The method is based on the direct analogy with the well known equilibrium theory of the electron gas and does not lead to a divergent equation of state. No arbitrary separations or cutoffs are necessary. The collision integral is a sum of three terms: a Lenard–Balescu integral involving the dynamically screened Coulomb potential, a Boltzmann term and a Fokker–Planck term both with the Debye shielded potential. Author (NSA)

N66-27342# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratorio Gas Ionizzati.
ON THE THEORY OF QUASISTATIONARY PLASMAS IN CONTACT WITH A WALL
A. Cavaliere, F. Engelmann, and G. Onori Aug. 1965 135 p refs
(LGI-65/21)

The problem of a quasistationary plasma in contact with a wall is treated by the boundary layer technique using a kinetic description for the motion of the ions. As typical examples, a low pressure discharge and a spherical electrostatic plasma probe are considered. The logical structure of the method is displayed, and a set of conditions is derived which insures a consistent matching between the plasma and sheath regions and generalizes the classical Bohm criterion. The universal character of the properties of the space charge dominated boundary layer is demonstrated, and it is shown that if a sheath is present, under very general conditions the electric field at the plasma edge as given by the boundary layer technique is formally infinite. Furthermore, it is discussed when a boundary layer has to appear. The general theory is applied to some simple models. Author (NSA)

N66-27352# California Univ., Livermore. Lawrence Radiation Lab.
ANOMALOUS ESCAPE OF IONS INTO THE "LOSS CONE" [ANOMAL'NYY UKHOD IONOV V "KONUS POTER"]
A. A. Galeev [1965] 21 p refs Transl. into ENGLISH of the Russian paper no. CN-21/214 Presented at the Intern. Atomic Energy Agency Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Culham, England, 6–10 Sep. 1965
(UCRL-TRANS-1275(L)) CFSTI: HC $1.00/MF $0.50

An investigation was made to determine the oscillation spectrum in an unstable plasma and the associated diffusion of ions into the loss cone which leads to the escape of ions from the trap through the magnetic mirrors. The leading results of the linear theory of instability are briefly reviewed and then generalized to the case of a partly filled loss cone. Discussions are then presented on nonlinear instability theory, turbulent diffusion of ions into the loss cone, and a model of stable collisionless plasma. NSA

N66-27396# Stanford Univ., Calif. Inst. for Plasma Research.
ELECTRON BEAM PROBING OF THE CATHODE SHEATH AND BEAM-PLASMA INTERACTION
A. B. Cannara Dec. 1965 76 p refs
(Contract AT(04-3)-326)
(SU-IPR-33) CFSTI: HC $3.00/MF $0.75

A non-perturbing electron beam probe was used to measure the a-c and r-f electric fields in, and beyond the cathode sheath of an ordinary, hot-cathode discharge. This technique was next applied to the measurement of the axial and radial r-f fields accompanying beam-plasma interaction in cylindrical geometry. Comparisons are made with recent, relevant theories. For the case of beam-plasma interaction, theories for both cold and warm plasmas are reviewed. Author (NSA)

N66-27401# Stanford Univ., Calif. Microwave Lab.
INSTABILITY AND AMPLIFICATION IN FINITE BEAM-PLASMA SYSTEMS. I: THEORY
S. A. Self Jan. 1965 48 p refs Submitted for Publication
(Contract AT(04-3)-326)
(ML-1292) CFSTI: HC $2.00/MF $0.50

A study was made of the stability of, and amplification along, a cylindrical electron beam of finite radius passing through a stationary plasma in the absence of steady magnetic field. In the theory, the dispersion relation is analyzed for two cases, when the plasma is unbounded and when it is bounded by a cylindrical conductor. The general criteria for determining instability and wave types were applied and it is found that, when there are no stabilizing effects such as collisions or temperature, the system is always absolutely (nonconvectively) unstable. The temporal growth rates of the instability are typically sufficiently low that in practical cases the effect of collisions is sufficient to stabilize the system, leaving it supporting an amplifying wave (convective instability) whose spatial growth rate is determined by the collision rate, and which may be very large indeed under conditions that the absolute instability is only just stabilized. A number of representative numerical solutions are presented. Author (NSA)

N66-27415# Oregon Univ., Eugene. Dept. of Physics.
QUANTUM THEORY OF DYNAMIC MAGNETORESISTANCE
Shigeji Fujita and Charles C. Chen (Ohio Univ.) Mar. 1966 23 p refs
(Contract Nonr-2771(05))
(TR-8; AD-630621) CFSTI: HC $2.60/MF $0.50

The connected-diagram expansion method is applied in the evaluation of the dynamic conductivity of an electron-impurity system subjected to a constant magnetic field B. This method treats the two cases, B does not=0 and B=0, on the same footing such that the differences appear at the final stage of calculation. A clear physical picture is sustained throughout because no extraneous arguments about the splitting of a density operator into diagonal and non-diagonal parts in free-electron states, which appeared in most of the past literatures, are used. A transport equation in the limits of low impurity density n_s and small coupling lambda is given explicitly. This equation is meant to describe the dynamic conductivity at an arbitrary frequency omega of an applying electric field and at an arbitrary magnitude of B. It reduces to the transport equation of Argyres in the limit of zero frequency and to that of Yamada–Ron in the limit of zero field. The conductivity in the limits of Ω, B, n_s and λ, is calculated explicitly. The limiting forms of the new expressions are in agreement with the result of Titeica (B=0, Ω=0) and with that of Yamada–Ron (B=0, Ω does not=0). The expression explicitly indicates that the dynamical response can be no more interpreted in terms of scattering cross section. The conductivity of an electron–phonon system is discussed briefly. Author (TAB)

N66-27475# Stanford Univ., Calif. Inst. for Plasma Research.
INSTABILITY OF THE STEADY STATE OF A PLASMA IN A UNIFORM ELECTRIC FIELD
G. F. Reiter Dec. 1965 35 p refs
(Contract AT(04-3)-326)
(SU-IPR-31) CFSTI: HC $2.00/MF $0.50

The BGK equations are used to obtain the steady-state velocity distribution for a uniform, fully ionized plasma in a d-c electric field. The Joule heating of the plasma is assumed to be compensated for by volume heat losses such as bremsstrahlung. The distribution obtained is far from Maxwellian if the drift currents are comparable to the thermal velocity. Longitudinal oscillations with wave vector in the direction of the field are introduced as a perturbation, and their dispersion relation is obtained. The stability of the steady state is investigated numerically, and it is found to be unstable for sufficiently high drift velocities, the instability being due to the familiar electron-ion two-stream interaction. The instability is impeded, but not prevented by collisions. Author (NSA)

N66-27504*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LIMITS OF VALIDITY OF RADIATIONLESS DECAY OF HIGH-DENSITY PLASMAS

Norbert Stankiewicz Washington, NASA, Jun. 1966 31 p refs
(NASA-TN-D-3372) CFSTI: HC $0.35/MF $0.50 CSCL 20I

The recombinative decay of collision-dominated plasmas is investigated theoretically, and the limit of validity of such radiationless models is determined. The density range considered conforms to those plasma densities usually encountered in the analysis of a magnetohydrodynamic generator. The results indicate that neglecting radiative processes may not always be justified at these densities. It is concluded that the radiationless model is valid for argon when the electron density is greater than 6.8×10^{15} per cubic centimeter for cesium when it is greater than 1.1×10^{15} per cubic centimeter. Author

N66-27529*# Stanford Research Inst., Menlo Park, Calif.
THE USE OF LANGMUIR PROBES TO DETERMINE THE ELECTRON DENSITY SURROUNDING RE-ENTRY VEHICLES Final Report
W. E. Scharfman Jun. 1965 77 p refs
(Contract NAS1-3942; SRI Proj. 5034)
(NASA-CR-75405) CFSTI: HC $3.00/MF $0.75 CSCL 20I

In this report classical probe theory is reviewed, and the conditions under which it is applicable are pointed out. Some later developments in probe theory that account for flow velocity in the free-molecular case are also discussed. The use of flush probes on re-entry vehicles is considered. The theory of ion collection using long cylinders in a supersonic flow has been confirmed over a range of electron densities by measurements in an arc-driven shock tube. Probe data were checked with equilibrium calculations and with a 33-Gc microwave interferometer. Agreement was better than a factor of two among the three means of determining electron density. Evidence is given for a scaling relation for cylindrical probes in continuum flow. The product n_+r_p (where n_+ is ion density and r_p is probe radius) is a constant with initial pressure and probe radius, and depends only on shock velocity. Preliminary results for a narrow wedge probe at zero-degrees angle of attack indicate that this geometry may be practical for use on re-entry vehicles. Preliminary measurements were also made with flush probes mounted in the walls of the shock tube. The measured results are interpreted using a simple boundary-layer theory for the electron concentration near the wall. Good qualitative and fair quantitative agreement were obtained. Author

N66-27538*# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
EXPERIMENTAL AND THEORETICAL RESEARCH ON PLASMA SHEATHS AND BOUNDARY LAYERS AROUND STAGNATION POINT ELECTRODES Semiannual Progress Report No. 3, 1 Jul.-31 Dec. 1965
Michael Ming Chen 23 May 1966 14 p refs
(Grant NsG-724)
(NASA-CR-75322) CFSTI: HC $1.00/MF $0.50 CSCL 20I

During the period covered by the report, a fairly detailed space resolved experimental survey of the plasma and electrode observables has been made. A parametric macroscopic theory has been developed for a self-sustained thermionic cathode. The stability theory for electrical conduction in a temperature dependent medium, which had been described previously, was being continued. In addition, a re-examination of the microscopic physical processes taking place in the sheath, electrode boundary layer and the electrode surface has been undertaken. Author

N66-27540*# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
EXPERIMENTAL INVESTIGATION OF STAGNATION POINT ELECTRODES
Michael Chen and E. Zimet [1966] 44 p refs
(Grant NsG-724)
(NASA-CR-75341) CFSTI: HC $2.00/MF $0.50 CSCL 20I

Results are presented of measurements conducted on an experimental electrode placed in the stagnation flow of a separately controlled arc heated plasma. Experimental emphasis was placed on seeking a configuration that would yield a stable reproducible discharge, and obtaining as much correlatable and space resolved data as possible. The experimental conditions, electrical characteristics of the electrode, electrode surface temperatures, spectroscopic results, and stark broadening are discussed. The results demonstrated that detailed space resolved measurements of either the plasma or solid observables can be made for an electrode operating in a dense flowing plasma. R.N.A.

N66-27543*# Michigan Univ., Ann Arbor. Plasma Engineering Lab.
PLASMA MEASUREMENTS FROM 3 TO 120 KILOBARS OF PRESSURE Final Report
James W. Robinson May 1966 51 p refs *Its* Rept.-05742-8-F
(Grant NsG-415)
(NASA-CR-75334) CFSTI: HC $3.00/MF $0.50 CSCL 20I

Measurements of pressure, temperature, resistivity, and energy density have been made for plasmas at pressures ranging from 3 to 120 kilobars and at temperatures of 10,000°K and 35,000° K. These plasmas have particle densities up to $10^{23}cm^{-3}$. The plasmas were formed by discharging a capacitor bank between electrodes submerged in water. Pressures up to 15 kilobars were obtained in this way, where the main source of pressure was the magnetic pinch effect. The inertial restraint of the plasma by water surrounding the discharge path also contributed to the pressure. For pressures up to 120 kilobars, a chemical explosive was detonated in the water near the electrical discharge path. The shock wave from the explosive established a region of water compressed to 100 kilobars, in which the column of plasma was formed. The data resistivity and energy density show resistivity decreasing with increasing pressure, and energy density increasing. At the lower pressures, the energy density is about 5 times that predicted by calculations based upon the Debye shielding theory. Because of the close spacing of the ions, their interactions can properly be analyzed only with quantum mechanics. Author

N66-27601# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE MOTION OF A PLASMA IN A GAS-DISCHARGE TUBE EQUIPPED WITH COAXIAL ELECTRODES
E. K. Chekalin, V. I. Trukhin, and A. I. Lozinskaya 17 Mar. 1966 24 p refs Transl. into ENGLISH from Fizicheskaya Gazodinamika Svoystva Gazov Pri Vysokikh Temperaturakh (USSR), 1964 p 59-72
(FTD-TT-65-1890/1+2+4; AD-630972) CFSTI: HC $1.00/MF $0.50

A study was made of the distribution of velocities of the forward glowing front of the plasma inside a coaxial accelerator in a wide range of an initial air pressure in the tube. Furthermore, observations were conducted on the outflow of plasma from the coaxial accelerator and the reflection of

plasma from the face of the tube. Time dependent recordings were made of the impulse of pressure on the face of the tube and of the glow of the plasma. The spectral composition of the plasma was also studied. TAB

N66-27615# ARO, Inc., Arnold Air Force Station, Tenn.
RELAXATION TO THE STEADY STATE IN A CONDUCTING NONEQUILIBRIUM PLASMA STREAM
Bill P. Curry Arnold Eng. Develop. Center, Apr. 1966 42 p refs
(Contract AF 40(600)-1200)
(AEDC-TR-66-43; AD-631504) CFSTI: HC $4.60/MF $0.50

The relaxation of a seeded plasma subjected to a constant electric field is considered within the formalism of the two-temperature theory. Numerical solutions are obtained for streamwise conductivity profiles in both argon and nitrogen plasmas seeded with potassium. Reaction rates used here are analytical formulae based on the Byron model for collision-induced recombination. Extensive analysis of the computed results and comparison with Zukoski's experiments in argon establish the validity of the basic treatment and suggest the existence of energy losses resulting from excitation of argon transitions originating at the first excited state, in addition to the usual elastic collision and potassium excitation energy losses. Details of the Byron model are validated by comparison of theoretical and experimental time-resolved potassium emission lines. Possible nonequilibrium effects in nitrogen are investigated with various assumed molecular excitation losses. Relaxation times for both types of plasmas are correlated by use of Zukoski's characteristic time parameter. Author

N66-27670# Northrop Space Labs., Hawthorne, Calif.
INVESTIGATION OF THE INTERACTION OF AN EXTERNAL MAGNETIC FIELD WITH AN ELECTRIC ARC Final Report, Dec. 1964-Dec. 1965
Harry N. Olsen, C. D. Maldonado, G. D. Duckworth, and A. P. Caron Wright-Patterson AFB, Ohio, Aerospace Res. Labs., Jan. 1966 113 p refs
(Contract AF 33(615)-1105)
(NSL-65-204; ARL-66-0016; AD-631672) CFSTI: HC $4.00/MF $0.75

A unique method was formulated mathematically for inverting the integral equation relating the integrated spectral intensity to the internal emission coefficient for any general geometry of an optically thin plasma. The method, specialized to the case of one mirror plane of symmetry, was programed for the IBM 7090 and properly tested by means of assumed analytical models. To demonstrate the practical nature of the inversion method as a research tool it was used to measure, for the first time, the absolute emission coefficient of the 6965 wavelength atomic spectral line emitted by the 400 ampere argon arc when distorted by a 36 Gauss external magnetic field. The computer program and test sample are included in the report. Author (TAB)

N66-27684# Little (Arthur D.), Inc., Cambridge, Mass.
CHARACTERISTICS OF METAL VAPOR Final Report, 15 May 1963-3 Oct. 1965
Alfred E. Wechsler Wright-Patterson AFB, Ohio, Aerospace Res. Labs., Jan. 1966 82 p refs *Its* Rept.-65636-2
(Contract AF 33(657)-11735)
(ARL-66-0004; AD-631489) CFSTI: HC $3.00/MF $0.75

The objectives were to examine the radiation attenuation properties of alkali metal vapors and their effects on the radiation heat transfer characteristics of arc and plasma systems. An absorption cell used to measure the transmittance of sodium, potassium and cesium vapor over the temperature range from 300° to 900°K with alkali partial pressures of 10^{-3} to 40 torr is described. A grating spectrometer was used with the cell to obtain data over the wave length region from 0.2 to 1.0 micron. Strong widespread absorption in the visible and near infrared regions caused by band absorption of the alkali metal molecules and absorption in narrow regions surrounding the first principal series lines of the alkali metal atoms were noted. Molecular absorption cross section values, calculated from plots of transmittance versus the effective vapor path length in the absorption cell, varied from 0.1 to 30 sq Å units, depending upon the alkali metal type and the wave length. The molecular cross sections for cesium were larger than for potassium; sodium had the smallest cross section. Effective atomic absorption cross sections were calculated in the regions where atomic absorption was dominant. Sample calculations based upon the measured cross sections indicated that up to 30% of the radiation emitted by a source at 10,000° K could be absorbed in a 2.5 cm layer of alkali metal vapor (cesium) in equilibrium at 400°C. Author (TAB)

N66-27705# Arkansas Univ., Fayetteville. Plasma Lab.
RESEARCH ON ENERGY TRANSFER PROBLEMS IN SUPERCONDUCTORS AND FLOWING PLASMAS Second Quarterly Progress Report, 1 Oct.-31 Dec. 1965
Denys O. Akhurst [1966] 9 p
(Contract DA-01-021-AMC-12820(Z))
(UAPL-26; AD-631743) CFSTI: HC $1.00/MF $0.50

A summary is given of progress in work involving: Analysis of energy extraction in superconductors; survey of magnetohydrodynamic power generation; shock tube verification of interaction theory. TAB

N66-27706# Columbia Univ., New York. Plasma Lab.
NORMAL IONIZING SHOCK WAVES
Robert T. Taussig 1965 184 p refs
(Contract AF 49(638)-1254)
(Rept.-23; AD-631372) CFSTI: HC $5.00/MF $1.00

Solutions to the steady state jump equations are obtained for a normal ionizing shock wave moving into a nonconducting, stationary gas in an electromagnetic field. The properties of ionizing shock waves common to pure MHD and to ordinary gas shocks are discussed. Coupling between electromagnetic and dissociation-ionization effects across the shock is analyzed. Numerical solutions are presented for several electric field strengths in molecular hydrogen using accurate thermodynamic properties and assuming that the gas upstream and downstream from the shock is in chemical equilibrium. The steady state problem of a current-driven shock wave is solved in the context of an electromagnetic annular shock tube. The results agree well with experimental evidence. Evolutionary normal ionizing shock wave solutions are selected and their stability determined in perfect fluid. A theory of shock wave stability in a fully dissipative fluid, based on recent work in magnetohydrodynamics, is outlined. TAB

N66-27745*# North American Aviation, Inc., Downey, Calif. Flight Sciences Dept.
FLOW FIELD PREDICTION AND ANALYSIS STUDY FOR PROJECT RAM B3 Final Report

W. H. Ball, H. G. Webb, Jr., and F. J. Lyon 20 Aug. 1965 196 p refs
(Contract NAS1-4743)
(NASA-CR-66106; SID-65-1113) CFSTI: HC $5.00/MF $1.25 CSCL 20I

This report presents the results of a theoretical analysis conducted to predict the flow field properties in the shock layer surrounding the RAM B3 vehicle shape for fourteen different flight conditions. These flight conditions varied along an ascent trajectory from an altitude of 124,775 ft at a velocity of 9,221 ft per second to an altitude of 247,373 ft at a velocity of 17,649 ft per second. Special emphasis was attached in this study to the determination of the flow field properties which are essential in the prediction of radio signal attenuation effects. The complete inviscid and viscous regions of the flow field were computed assuming chemical equilibrium using three digital computer programs. Nonequilibrium effects in the merged inviscid and viscous flow regions were computed by application of a one-dimensional reacting gas program along streamlines using appropriate matching parameters. Complete flow field properties were computed along eight streamlines for each case, and the property distribution profiles are presented along nine normals to the body surface spaced from the stagnation point to the aft end of the body. The results of the analysis show significant departures from chemical equilibrium conditions along the RAM B3 flight trajectory at both high altitudes and low flight velocities. Author

N66-27763# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.

A NONADIABATIC ELECTRODELESS ACCELERATOR FOR USE IN HYPERVELOCITY RESEARCH

R. Small, G. Connell, A. Lind, and E. Valsamakis Apr. 1964 35 p refs Presented at the 3d Hypervelocity Tech. Symp., Denver, 17–18 Mar. 1964
(RE-172J)

The nonadiabatic electrodeless accelerator currently being investigated shows promise as a versatile laboratory device for generating hypervelocity flows. An electrodeless accelerator provides a high purity gas sample over a wide range of densities, velocities, and per cent ionization. The nonadiabatic process, which results from a reversal of magnetic fields in a plasma, yields a large increase in the angular momentum of the particles and can result in high efficiencies of energy transfer. Velocities in the range of 10^4 meters per second have been obtained. Author

N66-27764# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.

EXPERIMENTAL INVESTIGATION OF MHD FLOWS THROUGH CIRCULAR PIPES AT HIGH HARTMANN AND REYNOLDS NUMBERS

A. Maciulaitis, A. L. Loeffler, Jr., and P. J. Calcanes Apr. 1966 21 p refs Presented at the Intern. Symp. on Magnetohydrodyn. Elec. Power Generation, Salzburg, Austria, 4–8 Jul. 1966
(RE-247J)

Magnetohydrodynamic turbulence using liquid mercury flowing through channels of circular cross section was investigated. Friction factors for fully developed flow in the presence of a uniform transverse magnetic field in dielectric circular pipes were determined. The apparatus is described in detail. The main section of the apparatus, utilizing a 2.5 in. pipe, was designed to take detailed velocity profile measurements. The second test section with a 5/16 in. pipe was designed to provide an independent check on the laminar friction factor results. In the turbulent regime, the friction factor was found to be a function of both the Hartmann/Reynolds number ratio (M/Re) and Re. In laminar flow at high Hartmann numbers, the friction factor was determined to obey a linear relationship with M/Re, but with a slope about 10% higher than previously predicted slopes. A minimum in the friction factor versus M/Re curve occurred in the transition region. The transition was found to be much less abrupt than in nonmagnetic flow and to be governed by M/Re. N.E.N.

N66-27773# Commissariat a l'Energie Atomique, Saclay (France). Services de Physique Appliques.

ELECTRONIC RADIATION OF A PLASMA IN A MAGNETIC FIELD [LE RAYONNEMENT ELECTRONIQUE D'UN PLASMA DANS UN CHAMP MAGNETIQUE]

Ernesto Canobbio, Terenzio Consoli, Georges Ichtchenko, and Francois Perlange Oct. 1965 45 p refs In FRENCH
(CEA-R-2881)

The influence on the microwave spectrum of the number of fast electrons, density, pressure, and plasma inhomogeneities was studied in a hot cathode reflex discharge, operating either in a steady state or in a pulsed regime. Under some conditions a strong emission is observed between the harmonics of the electron gyrofrequency. A theoretical interpretation of the results is advanced by extending a model already proposed by CANOBBIO and CROCI. In particular it is indicated that the transition radiation can be responsible for the emission observed between the harmonics. Author (NSA)

N66-27804# Innsbruck Univ. (Austria). Inst. for Theoretical Physics.

A NUMERICAL METHOD FOR SOLVING THE ONE-DIMENSIONAL UNSTEADY MGD BASIC EQUATIONS FOR FINITE MAGNETIC REYNOLDS NUMBER

Helmut Friedel 3 Jul. 1965 20 p refs
(Contract AF 61(052)-675)
(AFOSR-66-0348; AD-630832) CFSTI: HC $1.00/MF $0.50

A numerical method based on the theory of characteristics for solving the parabolically degenerated one-dimensional unsteady MGD basic equations is described. Convergence and stability of the numerical method are analyzed in detail. Author (TAB)

N66-27813# Maryland Univ., College Park.

NONLINEAR MECHANICS OF PLASMA-LIKE DISTRIBUTED MEDIA

Herbert Lashinsky Jan. 1966 28 p refs Presented at Symp. on the Dyn. of Plasmas and Fluids, College Park, Md., 6–8 Oct. 1965
(Grant AF-AFOSR-1016-66)
(BN-432; AFOSR-66-0616; AD-630677) CFSTI: HC $2.60/MF $0.50

The finite-amplitude controlled oscillations produced in a thermal-plasma device (Q-machine) as a result of the universal instability provide a useful tool for experimental research in the nonlinear mechanics of plasma-like distributed systems i.e., systems in which the pertinent physical parameters are distributed in one or more of the coordinate variables (position and velocity) used to describe the system, rather than lumped, as in more familiar vacuum-tube or mechanical configurations. Results obtained in such experiments have been analyzed by extending techniques of nonlinear mechanics to distributed systems. In particular, nonlinear phenomena such as mode competition and mode locking have been examined and the relation between these phenomena in plasmas and in related

systems such as the gaseous optical maser has been delineated. The current status of this work is reviewed with particular emphasis being given to the analysis of mode locking and the implications of this effect for turbulence in plasmas.
Author (TAB)

N66-27821# United Aircraft Corp., East Hartford, Conn. Research Labs.
NON-EQUILIBRIUM IONIZATION USING ELECTROSTATIC PROBING TECHNIQUES Final Technical Report, 1 Mar. 1965–28 Feb. 1966
Robert H. Bullis, Walter J. Wiegand, and Donald W. Ball 30 Mar. 1966 78 p refs
(Contract AF 49(638)-1551)
(E-920333-2; AFOSR-66-0633; AD-631005) CFSTI: HC $7.60/MF $0.75

The results of the research program were the determination of the effects of the presence of various inert background gases on the electron energy distribution, electron number density, and potential variation in the plasma of a cesium ignited-mode thermionic converter. Plasma properties are reported for a number of different ratios of inert gas background pressure to cesium pressure for the addition of inert species of xenon, krypton, and neon gases. The report relates findings of this investigation to the transport and ionization processes taking place in the ignited-mode converter through the use of recently available electron-cesium heavy particle cross-section information as well as the detailed information on the plasma properties obtained from the investigations reported in AD-621 276. In conjunction with the electrostatic probe measurements, spectroscopic investigations were conducted to determine the number density of electrons existing in the plasma. Also included in this report are a summary of the over-all accomplishments resulting from these investigations and a bibliography of the publications generated as a result of this study.
Author (TAB)

N66-27990# United Kingdom Atomic Energy Authority, Culham (England). Research Group.
A CALCULATION OF THE INTENSITIES OF OPTICALLY THICK LINES EMITTED BY HYDROGEN-LIKE IONS IN A STEADY-STATE PLASMA
A. G. Hearn Jan. 1966 45 p refs Submitted for Publication
(CLM-P97)

The intensities of optically thick lines emitted by hydrogen-like ions in a plasma which is in a steady state have been calculated for electron temperatures between 8000 Z^2°K and 256,000 Z^2°K and for electron densities between $10^8 Z^7$ cm^{-3} and $10^{18} Z^7$ cm^{-3}, where Z is the charge of the bare nucleus. The optical thickness of the plasma, which is conveniently measured at the centre of the Lyman α line, is between 0.1 and 100 for a uniform plane parallel plasma. The calculations solve the coupled equations of transfer when necessary for the first twenty levels for the absorption and stimulated emission of photons in the lines and include the processes of excitation, de-excitation and ionization by electron collision, spontaneous radiative decay, three-body recombination and radiative recombination. Tables give the total intensity of the Lyman α and β lines and the Balmer α and β lines, the total power radiated in the lines from both sides of the plasma and the geometrical size of the plasma. The population density of the ground level is given when this is not very small compared with the electron density.
Author

N66-28020*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
EFFECT OF MAGNETIC BEACH ON RF POWER ABSORPTION IN ION CYCLOTRON RESONANCE
Clyde C. Swett Washington, NASA, 1966 16 p refs Presented at the Am. Phys. Soc. Meeting, Minneapolis, 20–28 Jun. 1966
(NASA-TM-X-52210) CFSTI: HC $1.00/MF $0.50 CSCL 20I

Rf power transfer to ion-cyclotron waves in hydrogen and deuterium plasmas was experimentally investigated using a variable magnetic beach inside a magnetic-mirror geometry. The magnetic field at the minimum of the beach could be varied smoothly from 100 to 89 percent of the main axial field. Plasma power absorption at resonance (where the ratio of operating frequency to atomic hydrogen ion-cyclotron frequency, Ω, was 0.94) decreased 45 percent as the magnetic field at the beach was reduced to 89 percent of the main field. The value of Ω at resonance did not change with addition of the beach. A second extremely sharp resonance was noted at a magnetic field corresponding to $\Omega = 0.866$. Author

N66-28024*# National Bureau of Standards, Washington, D. C.
DEVELOPMENT OF A STABLE ULTRAVIOLET SOURCE AND TECHNIQUES FOR ACCURATE RADIOMETRY Annual Summary Report, 1 Jan.–31 Dec. 1965
Henry J. Kostkowski, Charles R. Yokley, Diamond E. Erminy, and Albert T. Hattenburg [1966] 98 p refs
(NASA Order R-117)
(NASA-CR-75552; NBS-9099) CFSTI: HC $3.00/MF $0.75 CSCL 20I

The characteristics of a small portable model of a high pressure plasma arc source and its associated equipment are described along with detailed drawings of some of its critical mechanical and electrical components. The philosophy, approach, results, and limitations of high accuracy spectral radiance calibrations of tungsten strip lamps are discussed. Results obtained from a determination of the low current gaphite arc spectral radiance from 8500 to 2100 Å using a high accuracy spectroradiometer are described. R.N.A.

N66-28047# Max-Planck-Institut für Physik und Astrophysik, Munich (West Germany).
PARTICLE LOSSES IN A WEAKLY IONIZED STATIONARY DC PLASMA IN A TOROIDAL MAGNETIC FIELD [LADUNGSTRAGERVERLUSTE IN EINEM SCHWACHIONISIERTEN STATIONAREN GLEICHSTROMPLASMA IM TOROIDALEN MAGNETFELD]
F. Karger Dec. 1965 59 p refs In GERMAN; ENGLISH summary
(MPI-PAE/PI.-21/65) CFSTI: HC $3.00/MF $0.50

For the particle losses of a weakly ionzed plasma which result from the torus-drift in the curved magnetic field, an expression is derived which is valid for certain parameter of the positive column of a gas discharge. To check this theory the "AMBIPOL" device was built to measure simultaneously the losses both in the toroidal and linear magnetic field by measuring the longitudinal electric field strength. A weaker decrease of the longitudinal electric field was observed in the toroidal part of the discharge as compared to the linear part. The measured values of the relative electric field strength, however, exceed the theoretical limit, although the measurements of the electric field in the straight part and the measurements of the particle density and of the electron temperature in the curved part are consistent with theory. Contrary

to the expectations, the onset of the KADOMTSEV instability occurs at lower critical magnetic fields in the toroidal part than in the straight part. Seven explanations are discussed. Author

N66-28053# Institut für Plasmaphysik G.m.b.H., Garching (West Germany).
POWER DENSITY OF AN MHD-GENERATOR CONSIDERING HALL-EFFECT AND ION-SLIP [LEISTUNG EINES MHD-GENERATORS UNTER BERUCKSICHTIGUNG VON HALL-EFFEKT UND IONENSCHLUPF]
W. Ohlendorff Mar. 1966 38 p In GERMAN; ENGLISH summary
(IPP-3/37) CFSTI: HC $2.00/MF $0.50

From the theory for MHD-generators the power-output of the usual generator-types has been calculated for the two cases of constant and variable conductivity, taking into account Hall-effect and ion-slip. Author

N66-28073# Boeing Scientific Research Labs., Seattle, Wash.
A REVIEW OF MAGNETO-HYDRODYNAMICS
Y. A. Yoler Oct. 1959 77 p refs *Its* Flight Sci. Lab. Rept.-14
(DI-82-0027)

A condensed review of the basic processes involved in certain classes of problems of engineering interest in fluid dynamics where magnetohydrodynamic effects are important is presented. Magnetohydrodynamic equations are briefly discussed, emphasizing the distinction between cases where the collisions and cases where the electromagnetic interactions predominate. Conducting fluid flows in a channel are considered, including the inviscid compressible fluid flow in a channel of slowly varying cross section and distinctions between the real fluid and a fictitious nonconducting fluid in a perfectly conducting fluid. The motion of a plasma column between two electrodes, and the motion of a plasma formed by an electrodeless discharge and accelerated by electromagnetic induction are discussed. The extension of the classical viscous flow problems of Couette and Poiseuille flows into magnetohydrodynamics is covered. N.E.N.

N66-28117# Lockheed Missiles and Space Co., Sunnyvale, Calif.
ABSORPTION OF HIGH-FREQUENCY ENERGY BY A PLASMA IN ION CYCLOTRON RESONANCE IN STRONG HIGH-FREQUENCY FIELDS
V. V. Chechkin, M. P. Vasil'ev, L. I. Grigor'eva, and B. I. Smerdov [1966] 14 p refs Transl. into ENGLISH from Vysokochastn. Syolatva Plazmy (Kiev), 1965 p 15-25

This paper is a continuation of previous investigations on the absorption of high frequency energy by a plasma in ion cyclotron resonance. Experimentally obtained data on high frequency energy absorption by a cold plasma near ion cyclotron resonance is compared with a previously developed theory to describe the character of this absorption. A connection is established between the effective frequency of ion collisions and anomalous diffusion of a plasma in ion cyclotron resonance. Some numerical estimates are conducted to show that both the absorption of high frequency energy by a plasma, and the anomalous diffusion of a plasma in fields with supercritical intensities might be due to a beam instability originating in the ion cyclotron wave field. R.N.A.

N66-28138# United Kingdom Atomic Energy Authority, Culham (England). Research Group.
PLASMA SHEATH Bibliography
L. S. Francis, comp. Jan. 1966 23 p refs
(CLM-BIB-6) HMSO: 3s

A bibliography with abstracts is presented on plasma sheaths and probes. Topics covered include: collision effects and collisionless plasmas; electrostatic, ion, moving, and Langmuir probes; ion currents and saturation currents; magnetic and nonmagnetic field effects; ion and electron temperatures, transition and boundary layers; oscillations and waves; low and high pressure effects; and stability, structure, geometry, and diffusion. N.E.N.

N66-28163# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Stuttgart (West Germany). Institut fuer Plasmadynamik.
BRIEF INVESTIGATION ON THE BEHAVIOR OF PLASMA THRUSTOR CATHODES IN THE PRESSURE RANGE FROM 15 TO 100 MM Hg [ZUR PHAENOMENOLOGIE VON PLASMATRIEBWERKS KATHODEN IM DRUCKBEREICH ZWISCHEN 15 UND 100 TORR]
Gerhard Kruelle Nov. 1965 33 p refs In GERMAN; ENGLISH summary
(DLR-FB-66-26; DVL-495) CFSTI: HC $2.00/MF $0.50

A thoriated tungsten cathode having a diameter of 8 mm and a length of 50 mm (back to the water-cooled end) was operated in a subsonic free jet flowing around the cathode coaxially from the rear end to the front. The variable parameters were the environmental static pressure (15–100 mm Hg), the gas type (Ar, He, H_2), and the operation current (600 and 1000 A). The cathode was photographed at the different operation conditions, and the temperature distribution along the cathode surface was measured by an optical pyrometer. The cathode behavior could be observed to be most strongly influenced by the gas type used in operation. In particular, the arc attachment would change substantially with the gas. The dependence on pressure differed greatly. It was strongest with Ar, and weakest with He. Author

N66-28184# United Kingdom Atomic Energy Authority, Culham (England).
DIFFUSION OF ANTI-PARALLEL BIAS MAGNETIC FIELD DURING THE INITIAL STAGES OF THETA-PINCH
T. S. Green and A. A. Newton Jan. 1966 15 p refs Submitted for Publication
(CLM-P-96)

In a study of the early stages of a theta pinch in reversed bias magnetic field it has been found experimentally that some of the bias flux is lost before the start of the implosion. The loss is a consequence of the hydromagnetic expansion of plasma and trapped field that occurs whilst the driving field reverses polarity. The amount of diffusion depends on the magnitude of the bias field relative to a certain critical field. Author

N66-28215# United Kingdom Atomic Energy Authority, Culham (England).
RADIAL IMPLOSION OF A PARTIALLY IONIZED PLASMA IN A THETA-PINCH
T. S. Green, A. A. Newton, and S. E. Segre 1966 19 p refs Submitted for Publication
(CLM-P93)

An investigation has been made of the radial implosion of a deuterium plasma in a theta-pinch under conditions in which the initial level of ionization was controlled. Measurements

were made of the diamagnetism of the plasma during the implosion and these have been related to the mass of gas in motion. The latter depends on the interaction between the ions and the neutral atoms. Analysis of the data shows that the effective cross-section for momentum transfer from ions to neutrals is 4×10^{-15} cm^2. This is close to the charge exchange cross-section for protons and hydrogen atoms. Author

N66-28241# Commissariat a l'Energie Atomique, Fontenay, aux-Roses (France). Centre d'Etudes Nucleaires.

DISPLACEMENT AND INTENSITY OF THE COMPONENTS OF HYDROGEN-ATOM LINES SUBJECTED TO A UNIFORM ELECTRICAL FIELD AND EXTERNAL MAGNETIC FIELD [DEPLACEMENT ET INTENSITE DES COMPOSANTES DES RAIES DE L'ATOME D'HYDROGENE SOUMIS A UN CHAMP ELECTRIQUE ET UN CHAMP MAGNETIQUE EXTERIEUR UNIFORMES]

L. Herman, H. Nguyen, H.-W. Drawin, B. Petropoulos, and C. Deutsch (Lab. de Rec. Phys., Sorbonne, Paris) Brussels, EURATOM, May 1966 68 p refs In FRENCH; ENGLISH summary Presented at the 7th Conf. Intern. sur les Phenomenes dans les Gaz Ionises, Belgrade, 22–27 Aug. 1965 (Contract EURATOM-007-62-1 FUAF)

(EUR-2604.f; CEA-R-2913) CFSTI: HC $3.00/MF $0.50

The wave equation for the hydrogen atom, perturbed by external constant electric and magnetic fields has been solved using the perturbation method, for an arbitrary angle between the two fields. The numerical solution has been carried out on electric computer. The obtained results have been tested using closed form expressions for particular cases, and also using "total intensity conservation rules". The most conspicuous features of the displacement and the intensity changes of the components of the H_α line, as a function of the field parameter A and the cosine of the angle between the two perturbing fields, are illustrated by some figures and a set of tables. Author

N66-28292# Technische Hochschule Aachen (West Germany).

INTERACTIONS OF AN ELECTRIC ARC PLASMA WITH TRANSVERSAL MAGNETIC FIELDS AND GAS FLOWS Scientific Summary Report, 1 Jun. 1964–30 Nov. 1965

E. Fischer, W. Fucks, and J. Uhlenbusch [1965] 28 p refs (Contract AF 61(052)-805)

(ARL-66-0077; AD-631569) CFSTI: HC $2.60/MF $0.50

Calculation is made of the temperature distribution and the flow field in a wall stabilized arc, which is burning in a constant magnetic field perpendicular to the arc axis. The interactions of an arc plasma with an external gas flow are treated for the column of a free burning arc exposed to a homogeneous flow of cold or preheated gas perpendicular to the arc axis, that is to the line between the electrodes. The arc fluctura, the flow field, and the temperature distribution are calculated. TAB

N66-28374*# National Aeronautics and Space Administration, Washington, D. C.

USE OF A PLASMA GUN FOR PRODUCING HIGH ELECTRON CURRENT PEAKS [ISPOL'ZOVANIYE PLAZMENNOY PUSHKI DLYA POLUCHENIYA BOL'SHIKH PIKOVYKH ZNACHENIY]

I. V. Kozhukhoz, Yu. V. Murstov, V. P. Rashevskiy, P. I. Ryl'tsev, V.P. Sarantsev et al Jun. 1966 16 p refs Transl. into ENGLISH from Pribory Tekhn. Eksperim. (USSR), no. 1, 1966 p 139–143

(NASA-TT-F-10206) CFSTI: HC $1.00/MF $0.50 CSCL 20I

The design of a plasma gun has been used to produce high peak values of electron current. Investigations of the effect of all parameters on the electron current have been made, and the possibilities of a plasma gun determined. Author

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N66-26999# Library of Congress, Washington, D. C. Aerospace Technology Div.

ORGANIC SEMICONDUCTORS Surveys of Soviet-Bloc Scientific and Technical Literature—Analytical Survey

Serge Markov 1 Apr. 1966 44 p refs

(ATD-66-35)

An annotated bibliography and analytical survey are presented of the Soviet open literature published between 1960 and 1965 on the following aspects of organic semiconductors: (1) heat-treated polyacrylonitrile, (2) irradiated and heat-treated polyethylene, (3) modified chlorine-containing polymers, and (4) modified polyvinyl alcohols. The electric properties of organic semiconductors and photoconductors are considered, along with their structure, morphology, and related magnetic properties. M.W.R.

N66-27040*# National Aeronautics and Space Administration, Washington, D. C.

MOTION PICTURE PHOTOGRAPHY OF VARIATION PROCESSES OF THE DOMAIN STRUCTURE OF THIN FERROMAGNETIC FILMS IN A MAGNETIC FIELD [KINOFLMIROVANIYE PROTSEESOV IZMENEIYA MAGNITNOY STRUCTURY TONKIKH FERROMAGNITNYKH PLENOR V MAGNITOM POLE]

L. V. Kirenskiy, V. A. Buravikhin, and M. K. Savchenko. 15 Sep. 1961 8 p refs Transl. into ENGLISH from Fiz. Metal. i Metalloved. (USSR), v. 11, no. 4, 1961 p 529–532

(NASA-TT-F-8071) CFSTI: HC $1.00/MF $0.50 CSCL 20L

Changes in the domain structure of thin films of two alloys (50% Fe, 50% Ni and 17% Fe, 80% Ni, 3% Mo) were studied by means of motion picture photography. The films, whose thickness varied from 760–2470 Å, were prepared by thermal deposition of the alloys on a glass plate in a vacuum and an external magnetic field of 100 oe. Study of the photographs shows that the domain structure of all ferromagnetic films remains stable until the magnetic field reaches some critical value. In relatively thick films, magnetization occurs with intermittent displacement of domain boundaries when the magnetic field reaches a critical value. No boundary displacement was observed in thinner films; their magnetization takes place with the destruction of domain boundaries and, in some cases, with a change in their structure or the appearance of new boundaries. Author

N66-27069*# Minnesota Univ., Minneapolis.

ON INTERNAL FRACTURE OF SOLIDS

C. C. Hsiao, S. R. Moghe, G. C. Soong, and W. L. Yin [1966] 46 p refs Presented at the Intern. Conf. of Fracture, Sendai, Japan, Sep. 1965

(Grant NGR-24-005-070)

(NASA-CR-67650) CFSTI: HC $2.00/MF $0.50 CSCL 20I

Three relevant analytical and experimental considerations on the initiation and propagation of internal fractur

in a solid are carried out. The initiation of internal fracture in the vicinity of a point as a result of converging tensile pulses is analyzed. A reasonable estimate of the state of stress near one of the foci of a prolate spheroid is obtained. Experimental success in reflecting and focusing sharp pulses and thus fracturing the neighborhood of a focus in a prolate spheroid is observed. The size of the internal fracture ranging from a pinpoint to a volume having more than 3 mm in diameter has been obtained. The propagation of a single crack in a solid is then analyzed. Viscoelastic behavior of the medium is considered and the time-dependent fracture information is given. Author

N66-27141# Hughes Research Labs., Malibu, Calif.
RESEARCH AND DEVELOPMENT ON SINGLE-CRYSTAL HIGH RESISTIVITY CADMIUM TELLURIDE FOR USE AS A GAMMA RAY SPECTROMETER Annual Report
N. A. Bailey Jun. 1965 43 p refs
(Contract AT(04-3)-549)
(SAN-549-1) CFSTI: HC $2.00/MF $0.50

Methods of preparing single crystals of CdTe were studied, as well as the properties of such crystals. Methods of preparing CdTe junctions were also investigated, and the characteristics of several diodes were measured. The response of the diodes to radiation was also studied. NSA

N66-27305# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
THE EFFECT OF PRESSURE AND TEMPERATURE ON THE EFFECTIVE MASS AND ENERGY GAP OF GAAS
Walter M. De Meis Aug. 1965 108 p refs
(Contracts Nonr-1866(10); ARPA SD-88)
(HP-15; ARPA-16; AD-621897) CFSTI: HC $4.00/MF $0.75

The report describes the results of an investigation of the effect of pressure and temperature on the energy gap and electron effective mass of GaAs. For this material, the applicability of the zero temperature Kane k·p theory at finite temperature was quantitatively tested by measuring the Faraday rotation as a function of pressure and temperature. The quantitative comparison of experimentally determined masses with theory required three subsidiary measurements: (1) the pressure change of energy gap of GaAs was found to be $dE_g/dP = (1.17 \pm 0.3) \times 10^{-5}$ eV/bar; (2) the long wavelength pressure change of refractive index of GaAs was found to be $(1/n)(dn/dP) = -(7.0 \pm 0.5) \cdot 10^{-7}$(1/bar); and (3) the long wavelength temperature change of refractive index of GaAs was confirmed to be $(1/n)(dn/dT) = (4.5 \pm 0.5) \times 10^{-5}$(1/°C). The results of measurements on three n-type samples of GaAs as a function of temperature and pressure show that the data were fitted best by using the Kane k·p theory at finite temperature with an energy gap corrected from 0° K by accounting only for lattice expansion, rather than the experimentally determined optical energy gap which may be considered to have an implicit temperature dependence due to lattice expansion and an explicit temperature dependence. Author (TAB)

N66-27321*# Georgia Inst. of Tech., Atlanta. School on Nuclear Engineering.
ELECTRON FLUX AND SPECTRUM IN THIN SILICON SAMPLES DURING GAMMA IRRADIATION—A COMPUTER STUDY
D. M. Walker and J. D. Clement Mar. 1966 73 p refs
(Grant NsG-657)
(NASA-CR-75390; NE-4) CFSTI: HC $3.00/MF $0.75
CSCL 20L

This report describes the first half of a two-step computation involving the calculation of electron flux and spectrum in thin silicon samples during gamma irradiation. The second step involves using this information as input to a Monte Carlo calculation of displacement production. A justification of the cross section equations used is given, the incorporation of these into an Algol computer program is described, and results of typical calculations are presented. Because the initial motivation of this work was its possible usefulness for analyzing spectrum effects in radiation damage studies for electronics devices, the applied relationship is noted throughout the paper. R.N.A.

N66-27332# Oak Ridge National Lab., Tenn.
RECOMBINATION AND TRAPPING IN ^{60}CO GAMMA-IRRADIATED N-TYPE GERMANIUM
B. G. Streetman (Ph.D. Thesis—Tex. Univ.) Feb. 1966 121 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1354) CFSTI: HC $4.00/MF $0.75

Carrier recombination and trapping processes were studied in n-type germanium irradiated at 77°K with ^{60}Co gamma rays. The experiment involved measurement of the carrier lifetime from 110° to 330°K by the photoconductive decay method. Irradiations and isochronal annealing studies were made on both Sb- and As-doped samples over a range of carrier concentrations. The samples were maintained in a vacuum during the entire irradiation-measurement-annealing procedure to eliminate variations in the surface effect. The irradiation produced a recombination level 0.35 eV above the valence band in Sb-doped material, and a level 0.32 eV above the valence band for As doping. The irradiation formed a hole trap at 0.37 eV above the valence band in the Sb-doped material, and the annealing created an additional trap 0.21 eV above the valence band. Each of these trapping centers exhibited a multiple negative charge at low temperatures. The annealing created the 0.21 eV level in considerable concentration and this center exhibited multiple trapping. The irradiation created a trap in As-doped material and a new trap during annealing. The energy level positions for these traps are uncertain, but both exhibited a multiple negative charge at low temperature. Most of the recombination centers annealed at 70°C in As-doped material, but a reverse anneal centered at about 180°C followed this stage. The annealing of recombination centers in Sb-doped material exhibited a reverse anneal at room temperature followed by two annealing stages centered at 70° and 130°C. The relative amount of annealing in these two stages was dependent upon the carrier concentration and the extent of the early reverse anneal. The carrier lifetime in the recombination region recovered essentially to its original value after annealing at about 250°C. Author (NSA)

N66-27344# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
SEMICONDUCTOR DETECTORS OF THE SURFACE BARRIER TYPE [RIVELATORI A SEMICONDUCTTORE DEL TIPO A BARRIERA SUPERFICIALE
D. Colante, J. Michalowicz, L. Parisi Presicce, and U. Spoglia Sep. 1965 17 p refs In ITALIAN
(RT/EL(65)7)

A method of making semiconductor surface barrier particle detectors and their epoxy resin encapsulation is described. The electrical and radiation testing results of devices are presented. Author (NSA)

N66-27353# Iowa State Univ. of Science and Technology, Ames.

ATOMIC ABSORPTION CENTERS AND LUMINESCENCE PHENOMENA IN HEAVY-ELEMENT ACTIVATED ALKALI-HALIDE PHOSPHORS, AND THEIR PREPARATION UNDER THE INFLUENCE OF BAND RADIATION

M. L. Kats [1965] 10 p refs Transl. into ENGLISH from Opt. i Spektroskopiya (Moscow), v. 3, 1957 p 602-609
(IS-TRANS-18) CFSTI: HC $1.00/MF $0.50

Crystalline alkali phosphors activated by silver, nickel, and tin ions were investigated. The absorption spectra of these phosphors consist of characteristic bands caused by activating admixtures. Excepting the case of nickel-activated phosphors, the light corresponding to the absorption bands of the activator induces fluorescence having a specific spectral composition. After exposure of the above-mentioned phosphors to band radiation, a sharp change was noted in their absorption spectra which exhibited a new band. New luminescence bands were also formed in the phosphors. The nature of these absorption and luminescence centers formed under the influence of band radiation is discussed on the basis of the results. Author (NSA)

N66-27354# California Univ., Berkeley. Lawrence Radiation Lab.

IDENTIFICATION OF PRISMATIC DISLOCATION DEFECTS BY ELECTRON MICROSCOPY

G. Thomas and W. L. Bell Aug. 1965 67 p refs Presented at the Conf. on Lattice Defects, Honolulu, Hawaii, Sep. 1965 Submitted for Publication
(Contract W-7405-ENG-48)
(UCRL-16271) CFSTI: HC $3.00/MF $0.75

Two techniques, viz. diffraction and strain contrast, for identifying large and small prismatic dislocation defects by transmission electron microscopy are described. Large defects can be analyzed by inspection. If the defect is a pure edge loop, the dislocation has uniform contrast and, if faulted, characteristic fringe contrast is observed. If loops are not pure edge, a double-arc dislocation image occurs containing a line of weak contrast that is always normal to the (projected) Burgers vector. Examples for fcc and bcc crystals are given. If the defect is large enough, the plane containing the dislocation loop can be identified. A method involving simple tilting experiments away from the $s=0$ condition in dark field is described that enables the sense of the defect to be determined (i.e., vacancy or interstitial). For defects too small to be adequately resolved by diffraction contrast, dark-field strain-contrast imaging must be used. It is shown how various kinds of possible defects can be distinguished, and the conditions required to produce and identify strain-contrast images are described. Author (NSA)

N66-27357# Oak Ridge National Lab., Tenn.

THE START OF PRECIPITATION FROM SUPERSATURATED SOLID SOLUTIONS

Erhard Hornbogen [1965] 65 p refs Transl. into ENGLISH from Z. Metallk. (Stuttgart), v. 56, no. 3, 1965 p 133-154
(ORNL-TR-637)

A survey was made of the phenomena of nucleation in solids. Crystal structure of matrix and nucleus, imperfections present in the matrix after solution treatment, volume change due to phase changes, and nature of the stresses between nucleus and matrix are discussed in relation to nucleation. The nucleation behavior of alloys is discussed considering different types of imperfections and the possibility of formation of metastable phases. To demonstrate the effects, nucleation diagrams are proposed. They show the starting time of nucleation as a function of aging temperature and alloy concentration with lattice imperfections and crystal structures of the nucleated phases as parameters. NSA

N66-27368# Kernforschungsanlage, Juelich (West Germany). Institut für Reaktorwerkstoffe.

SPUTTERING OF SOLIDS BY ION BOMBARDMENT [ZERSTABUNG VON FESTRORPERN DURCH IONENBESCHUSS]

Kyong-Tschong Rie Sep. 1965 10 p refs In GERMAN
(JUL-304-RW)

The role of the correlative collision in sputtering was investigated by the bombardment of single-crystal Ag and Cd with 1- to 7-keV Ar^+ ions. For the different orientations, the anisotropic emission of the surface atoms and the yield at various ion energies were determined. The structure of the deposition of the emitted atoms was measured for Ag at various temperatures. The experimental results were discussed on the basis of theoretical models. Experimental results of penetration experiments on Ag are included. The results obtained at 2-MeV proton energies were compared with those obtained previously at proton energies of 300 keV. The agreement was good. Author (NSA)

N66-27492*# National Aeronautics and Space Administration, Washington, D. C.

MEASUREMENT OF ABSOLUTE LUMINOSITY YIELD OF POWDERED PHOSPHORS [IZMERENIYE ABSOLYUTNOGO VYKHODA SVECHENIYA POROSHKOOBRAZ FOSFOROV]

V. V. Antonov-Romanovskiy and M. I. Epshteyn May 1966 13 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 64 no. 4, 1949 p 483-486
(NASA-TT-F-10111) CFSTI: HC $1.00/MF $0.50 CSCL 20L

Deficiencies in present methods of luminosity yield measurements are discussed, and an improved method is shown. Absolute yield was determined for two phosphors, ZnS-Cu and Zn_2SiO_4-Mn. The valves obtained and the quantum yield over the Stokes excitation region are discussed. Author

N66-27527*# Westinghouse Electric Corp., Baltimore, Md. Aerospace Div.

RESEARCH ON A PASSIVE MODULATION INDUCING RETRODIRECTIVE OPTICAL SYSTEM (MIROS) Final Report, 20 May 1963-20 Jun. 1964

[1964] 92 p refs
(Contract NASw-703)
(NASA-CR-75433) CFSTI: HC $3.00/MF $0.75 CSCL 20F

The primary purpose of this research program was to investigate methods whereby one beam of light could be used to modulate another beam of light with no power other than that contained in the two beams supplied to the modulation transfer element. After a preliminary investigation, it was concluded that the most promising modulation transfer schemes could be obtained by optical pumping methods. Several possible optical pumping methods were investigated, with two materials, mercury vapor, and an alkali halide, potassium iodide, singled out for laboratory experimentations. In the case of mercury vapor, the absorption-inducing line is the mercury 2537 Å resonance line, which corresponds to ground to first excited state transitions. The metastable 6^3P_0 level is populated by nitrogen quenching collisions. By populating this level, absorption of the 4047 Å line as high as 58 percent was observed. This modulation transfer scheme responded to modulation frequencies at least as high as 10 kc, when

system noise made higher frequency measurements unreliable. Theoretical work was found to agree reasonably well with experiment. In the alkali halide experiment, the modulating line was in the infrared and the modulated line was at 6943 Å. Results show that cross modulation is possible; however, frequency response is poor. Author

N66-27549# Brookhaven National Lab., Upton, N. Y.
ELECTRONIC BAND STRUCTURE AND OPTICAL PROPERTIES OF RARE-EARTH METALS
J. O. Dimmock (MIT, Lexington), A. J. Freeman (MIT, Cambridge), and R. E. Watson [1965] 18 p refs
(Contract AT(30-2)-GEN-16)
(BNL-9556; CONF-650804-10; MS-1438) CFSTI: HC $1.00/MF $0.50

The optical properties of the heavy rare-earth metals are discussed in the light of recent non-relativistic augmented plane wave (APW) calculations of the electronic energy band structures of Gd and Tm. The calculations show that the bands near the Fermi energy are of mixed s–d character, originating from atomic 5d and 6s states, are relatively flat, and yield a high density of states. The selection rules for interband optical transitions both with and without spin–orbit coupling included are given for the symmetry points in the Brillouin zone. This results in the prediction of considerable polarization dependent structure in the optical absorption and reflectivity of rare-earth metals in the infrared and visible regions. An anomaly also should exist in the uv region due to transitions between the 4f levels and the conduction bands above the Fermi energy. In Gd this anomaly is expected to occur at about 7 eV. Since the heavy rare-earth metals all order magnetically at low temperatures, an additional anomaly may arise due to transitions between magnetically split energy bands. Estimates of the energies of these splittings are made and compared with the energies of the infrared structure observed by Schüler in Ho and by Cooper and Redington in Dy.
Author (NSA)

N66-27551# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etude Nucleaires.
ANISOTROPY OF THE FLUORINE CHEMICAL SHIFT TENSOR IN UF_6 [ANISOTROPIE DU TENSEUR DE DEPLACEMENT CHIMIQUE DES FLUORS DANS UF_6]
Paul Rigny (Ph.D. Thesis—Paris Univ.) 28 Apr. 1965 30 p refs In FRENCH
(CEA-R-2827)

An ^{19}F magnetic resonance study of polycrystalline UF_6 is presented. The low temperature complex line can be analyzed as the superposition of two distinct lines, which is attributed to a distortion of the UF_6 octahedron in the solid. The shape of the two components is studied. Their width is much larger than the theoretical dipolar width, and must be explained by large anisotropies of the fluorine chemical shift tensors. The resulting shape functions of the powder spectra are determined. The values of the parameters of the chemical shift tensors yield estimates of the characters of the U—F bonds, and this gives some information on the ground state electronic wave function of the UF_6 molecule in the solid.
Author (NSA)

N66-27567# Emmanuel Coll., Boston, Mass. Research Language Center.
MEASUREMENT OF THE LIFETIME OF MINORITY CURRENT CARRIERS IN SEMICONDUCTORS BY OBSERVING THE PHOTOCONDUCTIVE DECAY OF THE SPREADING RESISTANCE UNDER A POINT CONTACT
Shou-wu Wang Bedford, Mass., AFCRL, Feb. 1966 30 p refs Transl. into ENGLISH from Wu Li Hsueh'pao (Peking), v. 19, no. 3, 1963 p 176–190
(Contract AF 19(628)-5073)
(EMM-65-14; AD-631119) CFSTI: HC $2.00/MF $0.50

The paper describes a new method for measuring the lifetime of minority current carriers in semiconductors by observing the photoconductive decay of the spreading resistance under a point contact. The method has the following advantages: (1) it is not necessary to cut the specimen into a special form; (2) no fixed electrode has to be attached to the specimen; (3) it is applicable to testing inhomogeneous specimens; (4) no particular surface treatments is necessary; (5) the apparatus used is simple and easy to operate; (6) the accuracy obtained is sufficient. The paper also gives a theoretical analysis of the effects of the surface recombination velocity and of the varying absorption depth of the light in the specimen. Experimental data on Ge and Si specimens are discussed. The results are in agreement with those obtained by other methods.
Author (TAB)

N66-27657# Delaware Univ., Newark. Dept. of Physics.
STATIONARY SOLUTIONS FOR INHOMOGENEOUS FIELD DISTRIBUTION IN HOMOGENEOUS SEMICONDUCTORS IN A RANGE OF NEGATIVE DIFFERENTIAL CONDUCTIVITY
K. W. Boer and P. L. Quinn Apr. 1966 17 p
(Contract DA-31-124-ARO(D)-173)
(AROD-4461-6; AD-631740) CFSTI: HC $1.00/MF $0.50

For a simple reaction-kinetic model of a homogeneous semiconductor layer-like field inhomogeneities have been shown to occur if and only if the decrease in conductivity is stronger than linear with increasing field. Such negative differential conductivity may be the result of either a field-dependent carrier concentration or a field-dependent mobility. The paper discusses the stationary solutions of a system of differential equations representing the reaction-kinetic models of both these cases. TAB

N66-27665# IIT Research Inst., Chicago, Ill. Technology Center.
MECHANICAL RELAXATION OF DEFECTS IN INSULATING CRYSTALS Final Report, Feb. 1, 1965–Jan. 31, 1966
P. D. Southgate Feb. 1966 94 p refs
(Grant DA-ARO-(D)-31-124-G528)
(IITRI-B6047-4; AROD-4518-7; AD-631335) CFSTI: HC $9.50/MF $0.75

Experimental and theoretical studies of problems in the anelastic losses due to point defects and dislocations in insulating crystals are described. Papers covering experimental work are included as appendices. Author (TAB)

N66-27684# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
SELF-DIFFUSION IN ICE SINGLE CRYSTALS
K. Itagaki Mar. 1966 22 p refs
(CRREL-RR-178; AD-631719) CFSTI: HC $2.00/MF $0.50

Measurements of the diffusion constants in single crystals of ice in directions parallel and perpendicular to the c-axis are described. The anisotropy of activation energy was obtained. The higher activation energy perpendicular to the c-axis indicates the free interstitial molecular jump mechanism for diffusion in ice. Author (TAB)

N66-27696# Franklin Inst., Philadelphia, Pa. Research Labs.
RESEARCH ON STRUCTURE AND MAGNETIC PROPERTIES OF EPITAXIALLY GROWN MAGNETIC FILMS Final Report, 17 Dec. 1962–16 Dec. 1965
W. D. Doyle, A. Baltz, J. Drew, and P. Flanders 28 Feb. 1966 44 p refs
(Contract AF 19(628)-2415)
(F-82046; AFCRL-66-179; AD-631317) CFSTI: HC $2.00/MF $0.50

Three major areas have been investigated. (1) An investigation of the role of imperfections in magnetic thin films has been conducted and a strong emphasis in this effort has been placed upon epitaxial properties. The results include an evaluation of voids in aged single crystals, an analysis of face-centered-cubic single crystal cobalt films and an investigation of 'ripple' as related to crystallographic properties of the epitaxial films. (2) A program to investigate the properties and origin of strip domains in various NiFe thin films was initiated. Methods for observing these domains were perfected and properties evaluated as a function of film fabrication parameters. (3) A large uniaxial anisotropy has been observed in NiFe films deposited on single crystal quartz substrates. Subsequent investigations show that its origin is a substrate-film constraint mechanism related to the planar strain system developed because of a difference in coefficients of the thermal expansion of the quartz and NiFe film. Author (TAB)

N66-27758*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THEORETICAL INVESTIGATION OF ULTRASONIC ATTENUATION FOR FREE ELECTRONS IN THE PRESENCE OF A MAGNETIC FIELD
Lawrence Flax (M.S. Thesis—John Carroll Univ.) 1966 58 p refs
(NASA-TM-X-57601) CFSTI: HC $3.00/MF $0.50

Several theoretical investigations are reviewed, which show that the attenuation of ultrasonic waves propagating through a metal depend strongly on the product of the wavelength q and the electrons mean free path *l*. An example is given which represents the phenomena of magnetoacoustic oscillations in which the attenuation shows as oscillatory dependence on the magnetic field. A previously published magnetoacoustic theory, which showed quantitative results for several experimental measurements on metals represented by a free electron model, is also examined. This theory is extended to show that it can predict the shift in extrema for the longitudinal case, and is adequate for all q*l* values. It is also shown that this theory goes directly over to the zero magnetic field case. Calculation procedures are detailed, with the relative attenuation coefficient determined from the nonvanishing components of the conductivity tensor. The equations used in simplifying the integral Bessel summation are formulated. Three cases are analyzed in detail: high magnetic field limit, low field limit, and magnetoacoustic oscillations. N.E.N.

N66-27799# Naval Ordnance Lab., Corona, Calif.
FOUNDATIONAL RESEARCH PROJECTS Quarterly Report, Oct.–Dec. 1965
J. L. Tomlinson et al 1 Mar. 1966 42 p refs
(NAVWEPS-8847; AD-630653) CFSTI: HC $4.60/MF $0.50

Contents: Magneto-optical observations with a ten-milliwatt helium-neon laser, by J. L. Tomlinson; Improved system for observation of highspeed magnetization reversal, by G. H. Moore; Infrared absorption of Ce^{3+} in LaF_3 and of CeF_3 by R. A. Buchanan, H. E. Rast, and H. H. Caspers; Synthesis study of a continuous-source waveguide antenna, by A. P. Bobiett. TAB

N66-27838# Army Foreign Science and Technology Center, Washington, D. C.
MEASUREMENT OF MINORITY CARRIER LIFETIME IN GERMANIUM AND SILICON BY THE SPREADING RESISTANCE PHOTO DECAY METHOD. CALORIMETRIC METHOD OF MEASURING ABSORBED POWER IN ELECTROLUMINESCENCE
Wei-hau Chuang, Kuei-Sheng P'an, Kuang-chi Chang, and Shao-hung Hsu Dec. 1965 26 p refs Transl. into ENGLISH from Wu Li Hsueh Pao (Peking), v. 18, no. 5, May 1962 p 250–253; v. 19, no. 3, Mar. 1963 p 191–201
(FSTC-381-T65-667; AD-630930) CFSTI: HC $2.00/MF $0.50

The photo-conductive decay of spreading resistance in contact with germanium and silicon of different surface conditions, subjected to photo-excitation of different spectral compositions was studied and a simple method for the measurement of semi-conductor lifetime is presented. The second paper describes the use of calorimetric method to measure electric power absorption in electroluminescence. The method is based on the principle of conservation of energy; therefore effects of harmonics and frequency in the measurement are eliminated. Preliminary experimental results indicate measurement error for readings under five microwatts (mW) is less than 5%. Author (TAB)

N66-27851# Institute of Modern Languages, Inc., Washington, D. C.
OPTICAL STUDIES ON ANODIC OXIDE FILMS (I AND II)
Tajima Sakae Fort Belvoir, Va., Army Engr. Res. and Develop. Labs., Apr. 1966 31 p refs Transl. into ENGLISH from Keikinzoku (Tokyo), v. 14, no. 4, 1964
(Contract DA-44-009-AMC-1563(T))
(ERDL-T-1842-66; TT-66-61029; AD-631171) CFSTI: HC $2.00/MF $0.50

OPTICAL ANALYSIS OF THE MECHANISM OF FORMATION OF ALPHA-ALUMINA FILM: Main constituents of the films produced in sodium and potassium bisulphate melts or their mixtures were confirmed to be alpha-Al_2O_3. The film formed in ammonium bisulphate melt contained an appreciable amount of gamma-alumina. The films formed in conc. H_2SO_4 or in conc. H_2SO_4–oleum, consist mainly of gamma-Al_2O_3, but by longer formation, it was partly converted to alpha-Al_2O_3. REFRACTIVE INDICES AND DOUBLE REFRACTION OF VARIOUS ANODIC OXIDE FILMS: Anodic oxide films such as oxalic, sulphuric acid films formed at normal anodizing conditions and at lower temperature (hard-coating), chromic, sulphamic, phosphoric, boric (plus sulphuric) acid films, Ematal and Kalcolor films and boric acid-formamide films developed by the authors, were observed under polarizing microscopy and the refractive indices were determined and the existence of doubly-refracting properties was checked. Refractive indices of these films are usually lower than pure crystalline or amorphous alumina 1.67±1. Author (TAB)

N66-27904# Army Materials Research Agency, Watertown, Mass. Materials Research Div.
MAGNETORESISTANCE OF COBALT
Alfred S. Marotta and Kenneth J. Tauer Jan. 1966 14 p refs
(AMRA-TR-66-02; AD-631068) CFSTI: HC $1.60/MF $0.50

Measurements were made on the longitudinal and transverse magnetoresistance to cobalt single crystals at 4.2°K. The principal changes due to the magnetic field are those of an ordinary metal plus effects peculiar to the magnetic state. In addition, Shubnikov-de Haas-like oscillations are observed in certain orientations. These are discussed as clues to the Fermi surface of cobalt. Author (TAB)

N66-27940*# Field Emission Corp., McMinnville, Oreg.
INVESTIGATIONS OF ELECTRON EMISSION CHARACTERISTICS OF LOW WORK FUNCTION SURFACES Quarterly Report No. 2, 1 Jan.–31 Mar. 1966
L. W. Swanson, A. E. Bell, and L. C. Crouser May 1966 38 p refs *Its* Rept.-6
(Contract NASw-1082)
(NASA-CR-75630) CFSTI: HC $2.00/MF $0.50 CSCL 20L

Co-adsorption studies of cesium and fluorine on tungsten have been initiated. Cesium adsorption and desorption occurs reversibly on top of a fluorine–tungsten layer. Pattern changes are nearly identical to cesium–oxygen co-adsorption on tungsten. Above 100°K the cesium is removed from the fluorinated tungsten surface. Careful energy distribution studies on the 112, 130, 110 and 100 planes of a clean and zirconium–oxygen coated tungsten emitter have been completed. Whereas the 130, 112 and 100 (when coated with zirconium) energy distribution results agree with the free electron theory of field emission, the 110 results yield anomalous values for the work function. Author

N66-27950*# Naval Ordnance Test Station, China Lake, Calif.
THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF THE PHYSICS OF CRYSTALLINE SURFACES First Quarterly Report, 1 Feb.–30 Apr. 1966
E. Bauer et al [1966] 66 p refs
(NASA Order R-05-030-001)
(NASA-CR-75641) CFSTI: HC $3.00/MF $0.75 CSCL 20L

Several theoretical and experimental investigations of the physics of crystalline surfaces are discussed. The studies described include: (1) the relationship between the structure of epitaxial films and surface and interfacial energies, (2) quantitative measurements of the elastic and inelastic interactions of slow electrons with W single crystal surfaces, (3) the determination of the nature and structure of surface layers with low energy electron diffraction, (4) the relationship between the structure and electron emission properties of work function reducing layers on W[110] planes, and (5) momentum exchanges of atoms on well defined single crystal surfaces. Emphasized are activities concerning (1) ultrahigh vacuum experiments concerning the formation of single crystal films of f.c.c. metals on alkali halide cleavage planes, and (2) the application of an ultrahigh vacuum electron microscope to work function studies. The uncertainty regarding reconstructed surfaces is also examined. L.S.

N66-27997# Battersea Coll. of Technology, London (England). Dept. of Metallurgy and Materials Technology.
INTERNAL FRICTION IN NIOBIUM–OXYGEN SOLID SOLUTION
Z. C. Szkopiak Risley, England, Reactor Group, United Kingdom Atomic Energy Authority, 1966 14 p refs
(TRG-1151(C/X)) HMSO: 1s 9d

A relationship has been established between the height of the internal friction relaxation peak for oxygen in niobium and the amount of oxygen present in niobium of commercial purity and in electron-beam refined material. The relationship takes the form $C_o = K \delta_{max}$, where C is the oxygen content (wt.%), δ_{max} is the logarithmic decrement corresponding to the relaxation peak and K is a parameter whose value varies with the distortion of the niobium lattice caused by substitutional impurities. Analysis of the latter effect indicates that it could be used as a method for the calculation of the effective diameters of interstitial atoms in solid solution with bcc metals. Author

N66-28181# Welsh Coll. of Advanced Technology, Cardiff.
THE THERMAL CONDUCTIVITY OF SEMICONDUCTORS AT LOW TEMPERATURES
S. D. Probert and C. B. Thomas Risley, England, Reactor Group, United Kingdom Atomic Energy Authority, 1966 42 p refs
(TRG-977(R/X)) HMSO: 5s

Heat transport in solids is due almost entirely to the vibrations of the crystal lattice and the motion of the electrons through the lattice. Any explanation of these phenomena is thus a many-body problem. Since an exact solution of this problem does not exist, certain plausible assumptions are often made which are given an increased air of verisimilitude by complicated mathematical techniques. The present review collates the products of a few selected esoteric arguments. It is hoped that this will help the experimentalist in the initial analysis of his results. Skeleton outlines of the arguments have also been included in a desire to present a review rather than a mere collection of 'algebraic' formulae. Author

N66-28268# Delaware Univ., Newark. Dept. of Physics.
INTRINSIC POINT DEFECTS IN CdS
K. W. Boer and J. C. O'Connell Apr. 1966 15 p refs Sponsored in part by NASA
(Contract Nonr-4336(00))
(TR-7; AD-631302) CFSTI: HC $1.60/MF $0.50

The unambiguous identification of intrinsic defects in semiconductors is essential for understanding the electronic microprocesses, involved in luminescence and photoconductivity. Progress has been made in identification of the sulfur vacancy and its influence on electrical properties. The sulfur vacancy was created by X-ray damage above a threshold energy between 250 and 300 keV. In order to minimize the influence of ambient gases, the X-ray damage was done in ultra-high vacuo ($p < 5 \times 10^{-10}$ torr). A sulfur vacancy is produced adjacent to the surface or low angle boundaries and its production can be impeded by preceding sulfur treatment of the crystal. The analysis of conductivity glow curves shows a level of 0.5 eV below the conduction band for this sulfur vacancy. Author (TAB)

N66-28301# General Electric Co., Schenectady, N. Y.
PHOTOMETALLIC PROCESS INVESTIGATION First Interim Development Report, 1 Dec. 1965–28 Feb. 1966
Donald L. Schaefer 16 Mar. 1966 33 p refs
(Contract NObsr 95045)
(AD-631330) CFSTI: HC $2.00/MF $0.50

The project has as its ultimate objective the fabrication of microminiature circuits in gold, nichrome, aluminum and silica by a process in which these materials are etched directly by a photosensitive material according to an incident light pattern. Potential light sensitive halogens, sulfides and cyanides have been evaluated in liquid solvents. The capability of such materials as photoetchants has been demonstrated. Such materials as iodoform, N-bromosuccinimide, N,N' dibromodimethylhydantoin, N-chlorosuccinimide, ferric chloride and potassium ferrocyanide show the most promise. Thirty-seven compounds were investigated. Nineteen of these were positive etchants for gold. Eight were positive etchants for nichrome. Author (TAB)

N66-28318# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
X-RAY DIFFRACTION STUDIES OF THERMAL MOTIONS IN CRYSTALS Quarterly Progress Report, 1 Sep.–31 Dec. 1966

R. A. Young 11 Mar. 1966 6 p
(Contracts Nonr-991(00); Nonr-991(06))
(QPR-26; AD-631382) CFSTI: HC $1.00/MF $0.50

Measurements were made on germanium and silicon samples to determine the temperature dependence of X-ray diffracted intensity without changing the temperature. The expected results were calculated by the method of Demarco and Weiss (Acta Cryst. 19:68 (1965)); to eliminate uncertainties in the measurements of incident intensity, the results for each crystal were normalized to the predicted value at one point. The measurements on silicon demonstrate a much larger variation from the predictions than do those of germanium. The 777 of germanium continues to show an anomaly relative to the other hhh planes but that this anomaly is not present in the silicon measurements. This method of measurement does not show a significant difference due to variation in dislocation density. Three of the silicon samples which were measured are to be submitted for fast neutron radiation damage. Sample no. 5 will be exposed to determine the damage versus integrated flux with X-ray integrated intensity measurements being made periodically during the exposure. It appears probable that the total exposure may be about 5×10^{21} nvt. The two larger ('monochromator') crystals will eventually be exposed to a degree dependent on the results of the no. 5 sample. TAB

N66-28343# Bureau of Mines, Norris, Tenn. Metallurgy Research Lab.
DIBORIDES IN THE PSEUDOBINARY SYSTEMS TiB_2-CrB_2: ELECTRICAL PROPERTIES
Gilbert M. Farrior 1965 31 p refs
(BM-RI-6691)

The electrical resistivity, the coefficient of electrical resistivity, the Hall coefficient, and the absolute thermoelectric power were determined for nine compositions of the TiB_2-CrB_2 subsystem. The numerical values of the electrical resistivity and the thermoelectric power were greater for the intermediate compositions than for the end members. The absolute values of the Hall coefficients and the coefficients of electrical resistivity were less for the intermediate compositions than for the end members. The electrical resistivities and Hall coefficients were about the order of magnitude of most metals—from 34 to 202 microhm-cm and from about 0 to -23.3×10^{-4} cm^3/coulomb. The thermoelectric power was somewhat greater than that of most metals—up to 15.6 microvolts per °C. Author

N66-28351# Los Alamos Scientific Lab., N. Mex.
DYNAMICS OF DISORDERED HARMONIC LATTICES IN ONE, TWO, AND THREE DIMENSIONS
Daniel N. Payton, III and William M. Visscher (Missouri Univ.)
31 Mar. 1966 22 p refs
(Contract W-7405-ENG-36)
(LA-3471-MS) CFSTI: HC $2.00/MF $0.50

Extensive numerical and analytic studies of vibrational spectra and normal modes of harmonic systems with varying degrees of substitutional disorder were made. The effects on frequencies and eigenvectors of random mixtures of two or more species of atoms with differing masses and differing couplings to nearest and next-nearest neighbors were investigated. Using the IBM-7030 digital computer, spectra for linear chains of 100,000 atoms were obtained. In order to keep machine running times less than 10 minutes, calculation in two and three dimensions were limited to arrays of approximately 1000 atoms. Particular emphasis is placed upon the properties of the vibrational spectra and localized modes of the two dimensional lattices. Varying composition, mass ratio, and order affect the spectra in two and three dimensions in ways analogous to those affected in the linear chain. Mention is made of possible means of verification of some qualitative features of the results. Author (NSA)

N66-28358# Brookhaven National Lab., Upton, N. Y.
PASSAGE OF CHARGED PARTICLES THROUGH CRYSTAL LATTICES
Cavid Erginsoy 21 Apr. 1965 16 p refs *Its* Lecture Ser. No. 46
(Contract AT(30-2)-GEN-16)
(BNL-944(T-390)) CFSTI: HC $1.00/MF $0.50

A series of experimental results are reviewed that show the influence of the crystalline structure of solids on the various phenomena accompanying the passage of charged particles through them. NSA

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N66-27047*# Dow Chemical Co., Midland, Mich.
STUDY TO DETERMINE AN IMPROVED METHOD FOR APOLLO PROPELLANT SYSTEM DECONTAMINATION AND PROPELLANT TANK DRYING, PHASE I Interim Report
28 Apr. 1966 214 p refs
(Contract NAS9-4605)
(NASA-CR-65371) CFSTI: HC $6.00/MF $1.25 CSCL 21H

This report describes work accomplished in Phase I of a study being conducted to determine an improved method for Apollo propulsion system decontamination. The work in this phase included studies of compatibility of solvent with propellant and components, methods of decontamination, efficiencies of solvents, temperature effect, diffusion rate of propellant from elastomers, removal of propellant from flushing solvents, and a survey of published literature, proprietary information, and private correspondence on the technology of decontamination of rocket propulsion systems. Author

N66-27181*# Atlantic Research Corp., Alexandria, Va.
STUDY OF PROPELLANT VALVE LEAKAGE IN A VACUUM Phase II Report, 14 Jan.–7 Mar. 1966
Ralph D. Gift, John A. Simmons, Joseph P. Copeland, Jaydee W. Miller, and Jack M. Spurlock 6 May 1966 112 p refs
(Contract NAS9-4494)
(NASA-CR-65363) CFSTI: HC $4.00/MF $0.75 CSCL 21I

The adverse effects of Aerozine-50 leakage through propellant valves into injector manifolds exposed to a vacuum environment were theoretically and experimentally investigated. A literature survey and mathematical analysis was made to elucidate the freezing characteristics of Aerozine-50. Quantitative relationships between the rate of leakage and the accumulation of frozen propellant within the flow passages of an injector mold were developed. Tests with a simulated injector system were performed to characterize the freezing and its dependency on selected parameters, and to determine the

extent of any flow stoppages caused by accumulation of frozen propellant. The test system consisted of a leaky ball valve, a length of glass pipe and a plate with a number of drilled holes, which simulated the propellant valve, manifold, and injector respectively. Results are presented in detail and discussed. Flow-rate, temperature, and pressure data are depicted graphically. L.S.

N66-27204# Naval Ordnance Test Station, China Lake, Calif.
EFFECTS OF VELOCITY AND MATERIAL PROPERTIES ON DESIGN LIMITS FOR LINEAR SHAPED CHARGES
Robert G. S. Sewell Oct. 1965 14 p refs
(NAVWEPS-8793; NOTS-TP-3894; AD-623085) CFSTI: HC $1.00/MF $0.50

This report discusses the design limits for linear shaped charges that are caused by the behavior properties of the linear shaped charge. In the study the jetting process for both mild steel and copper is examined. Author (TAB)

N66-27229*# General Dynamics/Convair, San Diego, Calif.
ATMOSPHERIC DIFFUSION OF FLUORINE FROM SPILLS OF FLUORINE-OXYGEN MIXTURES Summary Report, 5 Mar. 1965-31 Jan. 1966
10 May 1966 251 p refs
(Contract NAS3-3245)
(NASA-CR-54926; GDC-DDB66-001) CFSTI: HC $7.51/MF $2.25 CSCL 21I

Atmospheric diffusion tests were conducted to determine the plume trajectory and downwind boundary dosages for noncombustive and combustive fluorine spills under a variety of atmospheric conditions. The trajectory of a hot conflegration cloud resulting from spills of up to 3000 lb of a 30 percent LF_2/70 percent LO_2 mixture on fuel was determined by photographic recording and IBM 7094 computation. Two fluorine and two hydrogen fluoride atmospheric samplers in the sensitivity range of 1 to 500 ppm-min by volume were evaluated in field trials. The evaporation rate of liquid LF_2/LO_2 mixture from a simulated spill containment system was determined, and the blast overpressure associated with a LF_2/LO_2 reaction with RP-1 fuel was measured. The capability of Sycamore Test Site for fluorine testing was determined. Author

N66-27409# Litton Systems, Inc., Minneapolis, Minn. Applied Science Div.
ELECTROHYDRODYNAMIC REMOVAL OF MICROORGANISMS FROM HYDROCARBON FUELS Final Report, 25 Jun. 1963-20 Nov. 1965
L. Ruhnke, E. Will, and P. Pederson 20 Nov. 1965 138 p refs
(Contract DA-19-129-AMC-141(N))
(ASD-2905; AD-630889) CFSTI: HC $4.00/MF $1.00

The feasibility of removing microorganisms and other particulates from hydrocarbon fuels by electrostatic precipitation was studied. Theoretic investigations describe the physics of electrohydrodynamic precipitation and essential parameters influencing collection efficiency. Measurements of fuel characteristics and filter parameters have been made which led to the development of an electrohydrodynamic filter. Particulates and a liquid are unipolarly charged in a corona edge ionizer and then are flushed into a precipitation tube in which particulates are moved by Coulomb forces into porous nonconducting walls. A 10-gpm model showed filter efficiencies of at least 85 percent by number of particles larger than 1 micron diameter. The basic advantages of the method investigated are the low pressure drop over the filter element and the small size of the unit. Author (TAB)

N66-27411# Bureau of Mines, Bartlesville, Okla. Petroleum Research Center.
STORAGE STABILITY OF HIGH TEMPERATURE FUELS, Technical Report, Feb. 1965-Feb. 1966
Marvin L. Whisman and C. C. Ward Wright-Patterson AFB, Ohio, AF Aero Propulsion Lab., Feb. 1966 183 p refs
(AFAPL-TR-65-13, Pt. II; AD-630768) CFSTI: HC $5.00/MF $1.00

The report covers the second year's work on an investigation of the influence of fuel constituents on thermal stability during storage of Spec MIL-J-25656B type (JP-8) and other high temperature fuels. Ninety-four test blends representing 12 fuels and 9 radioactive fuel components were prepared, tested and stored at 130°F in the evaluation of a microscale thermal stability procedure developed for the purpose of determining the contribution of selected fuel components to thermally induced deposits. Sixty-four of these test blends reached 26 weeks storage interval and were retested to determine the effect of storage upon deposit-forming tendencies. A study of several variables associated with a dynamic microhydrogenation method using tritium as the index of reactivity was completed. Final investigations with a series of test fuels and pure hydrocarbons concluded the application of the technique. An alternate static system of hydrogenation utilizing active metal catalysts prepared by the in situ treatment of the metal salt with sodium borohydride, and the in situ generation of hydrogen from sodium borohydride was completed. A revised procedure employing tritium labeled borohydride was likewise developed and evaluated. Author (TAB)

N66-28161# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
PROGRAMMED METHOD FOR THE DETERMINATION OF PROPELLANT CHARACTERISTICS (FROZEN EXPANSION) [METHODE PROGRAMMEE DE CALCUL DES PERFORMANCES DE PROPERGOLS (DETENTE FIGEE)]
Bernard Crampel, Simone Barrère, and M. Paule Lemaitre 1965 139 p ref In FRENCH; ENGLISH summary
(TN-91(1965)) CFSTI: HC $4.00/MF $1.00

A computer method was developed to determine the characteristics of rocket propellants, assuming a frozen expansion. The calculation of the equilibrium composition of multiphased chemical systems was used as a subroutine; this permits the evaluation of propellants consisting of up to twenty elements. The detailed working conditions of the program are described; and the general organization of the program is given. In addition, the Fortran vocabulary and the symbolic program are presented. D.T.

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N66-26835# Federal Aviation Agency, Washington, D. C. Aircraft Development Service.
INVESTIGATION OF TURBOJET ENGINE CHARACTERISTICS DURING BIRD INGESTION Final Report

Donald M. Miller Jan. 1966 27 p refs
(ADS-58)

Tests were conducted to determine specific reactions to the ingestion of birds by a twin-spool axial-flow turbojet engine. Various quantities of birds were propelled into the engine inlet at velocities on the order of 125 knots by a compressed air gun. The engine was subjected to ingestion of a total of 59 starlings in densities ranging from 3 to 20 birds per test and one sea gull. Transient and steady-state engine performance was monitored and recorded during and following ingestion sequences. An abrupt fluctuation in engine performance was sustained in all tests conducted with subsequent engine recovery and stabilization being attained in approximately two seconds, with the exception of one test which required manual manipulation of engine controls prior to engine recovery. This test involved the ingestion of 20 birds and resulted in a continuous compressor stall condition until corrective action was taken. Residual contamination of the engine resulted in some decreases in overall engine efficiency. Substantial damage was incurred by the inlet guide vanes and the first stage compressor rotor blades during the course of the program. Author

N66-27012# General Electric Co., Cincinnati, Ohio.
SMALL GAS TURBINE ENGINE COMPRESSOR TECHNOLOGY Technical Progress Report, Dec. 12, 1965–Jan. 12, 1966
13 Jan. 1966 25 p
(Contract DA-44-177-AMC-180(T))
(TPR-20)

Progress is reported in a program to advance and demonstrate high pressure ratio compressor technology for small gas turbine engines. This includes modifications and improvements in inlet vane systems, instrumentation, and test components. Also included is a paper which discusses an evaluation of a Lebow liquid cooled slipring for use up to 42,000 rpm in transmitting strain and temperature data for turbomachinery. C.T.C.

N66-27031*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE SCRAMJET
John C. Evvard [1965] 11 p Presented at the 8th Ann. Missile and Space Technol. Inst., Conn. Univ., 4–5 Aug. 1955
(NASA-TM-X-56755) CFSTI: HC $1.00/MF $0.50 CSCL 21A

The static temperatures and pressures, and stagnation temperature and pressures for the subsonic and supersonic combustion ramjet are discussed, along with the acute diffusion problem. Equations are developed, and the modes of operation of the subsonic and supersonic combustion chambers are differentiated. It was concluded that the supersonic combustion offers promise of: very reasonable pressures in the combustion chamber; relief from the problems associated with high temperature dissociation of the fluid; relief from the severe variable geometry requirements of inlet and exhaust nozzle; and simplified diffuser requirements and engine design. N.E.N.

N66-27061*# Hughes Research Labs., Malibu, Calif.
DEVELOPMENT OF LINEAR STRIP ION THRUSTORS Semiannual Report
J. R. Anderson, R. Kuberek, J. W. Pleifer, J. D. Smith, S. A. Thompson et al Jan. 1966 121 p
(Contract NAS3-7927)
(NASA-CR-54685; HRL-7927-SA) CFSTI: HC $4.00/MF $1.00 CSCL 21C

This report describes the first half of a program for the development of a linear ion thrustor and a cesium feed system for possible satellite control systems application. The major effort is being devoted to cyclic tests of two thrustors with cesium and development of a liquid-transfer cesium feed system for zero-gravity applications in space. Related tasks are directed toward determining the thrustor vibration sensitivity and advanced development of the thrustor, and demonstrating a two-thrustor station with electrostatic ion beam deflection. Author

N66-27062# General Motors Corp., Indianapolis, Ind. Allison Div.
TRANSMISSION DESIGN FOR AIRCRAFT GAS TURBINES
W. L. Mc Intire and C. M. Hawkins *In its* Allison Res. and Eng., Vol. No. 9 1966 p 18–25 (See N66-27060 15-34)

The subject paper presents a discussion of the transmission design considerations required for the aircraft gas turbine engine. A review is presented of the aircraft system requirements which influence turbo-prop transmission design. Modern transmission design concepts required for the gas turbine engine system are also discussed. Mechanical design features relating to materials, processes, and manufacturing are included. In summary, a review of experience from turbo-prop engine service and design follow-up is presented. Author

N66-27234*# Aerojet-General Corp., Sacramento, Calif. Liquid Rocket Operations.
THE MECHANICAL DESIGN OF A TWO-STAGE IMPULSE TURBINE FOR THE LIQUID HYDROGEN TURBOPUMP OF THE M-1 ENGINE
T. W. Reynolds 30 May 1966 79 p refs
(Contract NAS3-2555)
(NASA-CR-54821; AGC-8800-58) CFSTI: HC $3.00/MF $0.75 CSCL 21H

This report describes the mechanical and structural design of the two-row Curtis turbine for the hydrogen turbopump of the M-1 Engine. The turbine is a lightweight direct drive unit with a design point power output of 88,150 hp at 13,225 rpm, and a thermal efficiency of 62.8%. Operating temperature gradients from −420°F to +1200°F are accommodated by fabricating the housings from thin, welded shells of Inconel 718 alloy and supporting the housings near the axial center point of the blade rows by an external frame. Author

N66-27588# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
OPTIMAL COMBINATION OF PROPULSION SYSTEMS
Yu. N. Ivanov 15 Feb. 1966 28 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauki Mekhan. i Mashinostr. (Moscow), no. 2, 1964 p 9–18
(Contract NOw-62-0604-c)
(TG-230-T464; TT-66-60038; AD-630826) CFSTI: HC $2.60/MF $0.50

If two or more propulsion systems are jointly installed on a space vehicle, it is necessary to know the conditions of their optimal combination. In the paper there is considered a method of solving the variational problem of the optimal combination of arbitrary propulsion systems, and a study is made of the problem of the optimal combination of engines of limited exhaust velocity with engines of limited power. The weight of an engine of limited exhaust velocity is considered as being proportional to the maximum thrust; the weight of an

engine with limited power is assumed in one case to be proportional to the maximum power, and in another case to be equal to the sum of two terms, one of which is proportional to the maximum power and the other to the maximum thrust. Author (TAB)

N66-27605# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

RAMJET TECHNOLOGY. CHAPTER 8: AIR-FUEL MIXTURE PREPARATION

Malcolm A. Weiss and John H. Morgenthaler Jan. 1966 91 p refs

(Contract NOw-62-0604-c)

(TG-610; AD-630828) CFSTI: HC $3.00/MF $0.75

Liquid fuels must undergo atomization, mixing, and evaporation before combustion occurs. It is convenient to consider these processes separately, but this separation should not obscure that fact that the processes usually occur concurrently rather than consecutively. None of the three is understood well enough for rigid design of practical combustors from first principles. However, enough is known to guide the designer in improving existing combustor systems, as well as for establishing new designs. The three processes are discussed in detail in this chapter. Author (TAB)

N66-27739*# Aerojet-General Corp., Sacramento, Calif. Liquid Rocket Operations.

DEVELOPMENT OF LO_2/LH_2 GAS GENERATORS FOR THE M-1 ENGINE

J. I. Ito 1 Jun. 1966 88 p refs

(Contract NAS3-2555)

(NASA-CR-54812; AGC-8800-59) CFSTI: HC $3.00/MF $0.75 CSCL 21H

The current technology for a 120,000 horsepower liquid oxygen/liquid hydrogen gas generator that was successfully designed and tested for the M-1 engine program is summarized. Nominal gas generator operating conditions for the 8.125-in. diameter and 20-in. long chamber were: 1145 psia chamber pressure, 110.4 lbm/sec flowrate, and 0.80 mixture ratio. A successful coaxial injector design achieved 98% of theoretical combustion efficiency and local gas temperature at the chamber exit varied from 900°F to 1300°F. Limited test data with unbaffled injectors indicated injection velocity ratios (fuel injection velocity/oxidizer injection velocity) of approximately 10 might suppress high frequency combustion instability. Low frequency combustion oscillations, which occurred with a low amplitude during the turbopump development tests with gas generator drive, are also discussed in this report. Author

N66-27748*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

DEVELOPMENT OF THE POST-INJECTION PROPULSION SYSTEM FOR THE MARINER C SPACECRAFT

Bruce W. Schmitz, Thomas A. Groudle, and James H. Kelley 1 Apr. 1966 53 p refs

(Contract NAS7-100)

(NASA-CR-75863; JPL-TR-32-830) CFSTI: HC $3.00/MF $0.50 CSCL 21H

This report describes the design, development, and operation of the post-injection propulsion system utilized in the Mariner C spacecraft. The propulsion unit consists of a small monopropellant, hydrazine-fueled rocket of 50-lbf vacuum thrust, capable of delivering a variable total impulse in conjunction with a timer-shutoff system. Functionally, the rocket is of the pressure-fed constant-thrust type. Injection pressure is obtained from a compressed gas—nitrogen—that passes through a pressure regulator and forces the propellant from a bladdered tank to the rocket engine. The rocket engine contains a quantity of catalyst to accelerate the decomposition of anhydrous hydrazine. Engine ignition is accomplished through the injection of a small quantity of a hypergolic oxidizer, nitrogen tetroxide. All valving functions for the propulsion unit are accomplished with explosively actuated valves. The propulsion system is capable of two ignitions and thrust terminations. Inflight performance of the propulsion system as a portion of the Mariner III and Mariner IV missions is described. Author

N66-27827# Library of Congress, Washington, D. C. Aerospace Technology Div.

PROBLEMS OF SPACE AIR BREATHING JET ENGINES Surveys of Soviet Scientific and Technical Literature

I. A. Merkulov 17 Jan. 1966 23 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Energetika i Transport (Moscow), no. 5, 1965 p 159–172

(ATD-66-8; AD-630764) CFSTI: HC $1.00/MF $0.50

The paper presents the results of a thermodynamic investigation of an air-breathing jet engine (ABJE) in the 5–50 M range. It is intended to present general criteria for determining ABJE efficiency, i.e., to establish the ABJE thrust criteria, which would permit the determination of the engine's thrust capacity at given initial parameters without using gas dynamic calculations. Formulas for ABEJ thrust criteria are given and it is demonstrated that these engines may develop a positive thrust at space flight speeds, if heat and an additional mass are introduced into the engine's air flow. The equivalence of the supplied mass of heat is established according to the engine thrust. It is demonstrated that the mass heat equivalent decreases as the flight speed increases. Calculated values of the specific impulse of an ABJE equipped with various types of diffusors at space flight speeds are given. The article is divided into six parts: Introduction, Mechanical energy losses in an ABJE diffusor, Engine with a heat supply, Engine with heat and mass supply, Specific impulse of space air breathing jet engines, and Conclusions. The foremost conclusion is that the air-breathing jet engine, with heat and additional mass fed into the air flow, can develop a positive thrust at space flight speeds. Author (TAB)

N66-28015*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

SOLAR-ELECTRIC PROPULSION SYSTEM PERFORMANCE FOR THE 0.1-AU SOLAR PROBE MISSION

William C. Streck Washington, NASA, 1966 32 p refs Presented at the Am. Inst. of Aeronautics and Astronautics West Coast Aerospace Sci. Meeting, Los Angeles, 27–29 Jun. 1966

(NASA-TM-X-52201) CFSTI: HC $2.00/MF $0.50 CSCL 21C

Saturn IB/Centaur and Atlas/Centaur launched electric propulsion vehicles employing present or near-future state-of-the-art power supplies (50 to 100 lb/kW_e) are shown to be attractive systems for performing the 0.1-AU solar probe mission. This result compares favorably with the alternative systems composed of the same boosters but with chemical or nuclear final stages—which are inadequate for this mission. The performance calculations for the electric propulsion systems include the optimization of the launch vehicle burnout velocity, the electric stage specific impulse and power level, and the thrust orientation for constant specific impulse thrusters. Two sets of results are presented. The first set is associated with constant power operation of the thrusters as would

be the case for nonsolar dependent power supplies such as nuclear-electric systems. The second set of data represents solar-cell-powered electric systems. In this case the thrustor power is a function of the sun-vehicle distance. The power is varied by adjustment of the propellant flow rate. Of special interest is the fact that absolute optimal trajectories for the solar cell systems belong to an entirely different class than those optimals associated with constant power systems. Author

N66-28052# Kaman Aircraft Corp., Bloomfield, Conn.
A STUDY OF TWIN-ENGINE AIRPLANE PROPELLER INTERCONNECTION Final Report, Jul.-Nov. 1965
Robert B. Bossler, Jr. Jan. 1966 85 p refs
(Contract FA-65-WA-1385)
(FAA-ADS-59)

A feasibility study was made of cross-shafting systems which would interconnect propellers of light, twin-engine airplanes, eliminating asymmetric thrust caused by single-engine failures. The study found conventional engine-propeller arrangement, with interconnection added, superior to fuselage-mounted multiengine drive of interconnected wing-mounted propellers. Safety and operating costs were discussed. The Aero Commander 680F was selected for modification analysis. Compared to an unmodified aircraft, two-engine performance decreases slightly, but the important single-engine climb performance is increased by 70 feet per minute and the distance to take-off and climb to an altitude of 50 feet, assuming an engine failure at 100 miles per hour, is reduced by 317 feet. This study also included: detail design of the selected interconnect and the aircraft modification, manufacture and installation of the system in the aircraft, and analysis and testing required to obtain a supplemental type certificate. Author

N66-28122# Boeing Co., Huntsville, Ala. Launch Systems Branch.
260-INCH SOLID MOTOR/S-II VEHICLE FEASIBILITY STUDY Final Report
30 Jul. 1965 98 p refs
(Contract N174-15038(X))
(D5-13148)

This report presents the results of a feasibility study for a proposed launch vehicle consisting of a 260-inch diameter solid propellant rocket motor first stage and an S-11 second stage. The following results were obtained from the study effort and are included in this report: baseline vehicle configuration including physical description and weight statement; payload capability for a 100-nautical mile circular earth orbit; vehicle stability and control requirements; structural loads anticipated during flight inclusive of buffeting of the interstage, structural loads due to ground winds, and comparison of these loads with structural capabilities of the 260-inch solid motor and the S-II stage; outline of significant problem areas uncovered during the analysis; and recommendations for future studies as indicated from the above results. Author

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N66-28946# General Electric Co., Philadelphia, Pa. Missile and Space Div.
STATISTICAL EVIDENCE FOR A MAGNETIC FIELD OF MERCURY
R. C. Good, Jr. Mar. 1966 22 p refs
(R65SD8)

The heliographic longitude of the planet Mercury has been noted for each solar proton event recorded on Earth. When compared with the heliographic longitude of the attending solar flares 14, instead of the average 6, out of the 30 events occurred when Mercury was within 40°. This phenomenon seems to indicate that Mercury may influence the solar flare proton trajectories to increase the flux striking the Earth. The differential equations of motion for 100 Mev protons in a restricted magnetic dipole-type field are solved for trajectories on the magnetic equator. The exit angle i.e., deflection from original direction, is found to have a broad maximum near 80°. This compares well with astronomical data on the position of the planet Mercury. An estimation of the magnetic moment necessary to accomplish such deflections is shown to be reasonable since it would produce a magnetic field of 0.008 Gauss on the surface of Mercury. Author

N66-26986# Kiruna Geophysical Observatory (Sweden).
BALLOON-BORNE MEASUREMENTS OF SOLAR IONIZING RADIATION Final Report, 1 Jul. 1962-30 Jun. 1965
Willi Riedler, comp. 31 Oct. 1965 269 p refs
(Contract AF 61(052)-604)
(AFCRL-66-34; AD-628761) CFSTI: HC $26.10/MF $1.50

CONTENTS:

1. MEASUREMENTS OF HIGH ENERGETIC AURORAL RADIATIONS WITH BALLOON-BORNE DETECTORS IN 1962 AND 1963 G. A. Pfotzer and A. Ehmert (Max-Planck-Institut für Aeronomie, Lindau uber Northeim) 110 p refs (See N66-26987 15-29)
2. X-RAY MEASUREMENTS IN THE AURORAL ZONE FROM JULY TO OCTOBER 1964 G. Kremser, E. Keppler, A. Bewerskorff, K. H. Seeger, A. Ehmert et al 115 p refs (See N66-26988 15-29)

N66-26987# Max-Planck-Institut für Aeronomie, Lindau uber Northeim (West Germany). Institut für Stratosphärenphysik.
MEASUREMENTS OF HIGH ENERGETIC AURORAL RADIATIONS WITH BALLOON-BORNE DETECTORS IN 1962 AND 1963
G. A. Pfotzer and A. Ehmert, comp. *In* Kiruna Geophys. Obs. Balloon-Borne Meas. of Solar Ionizing Radiation 31 Oct. 1965 110 p refs (See N66-26986 15-29) CFSTI: HC $26.10/MF $1.50
(Rept.-13)

Data are discussed and presented in graphical form for events observed in the northern auroral zone during balloon flights. Only records of flights which indicated counting rates greater than those due to galactic cosmic radiation are included in this compilation of rough flight data. A description of the general flight situation as determined by solar activity level is presented. For most of the observations polyethylene sky-hook balloons were used. Three types of detectors were employed: (1) a combination of a GM-threefold coincidence telescope, a single GM-counter with vertically pointing axis, and an ionization chamber; (2) a three fold GM-telescope by itself; and (3) a telescope combined with a sodium iodide scintillation counter. During the 1963 balloon launchings a great number of X-ray bursts and a single proton event were

measured. Data are given for all these events, and the latter is compared with measurements by the Alouette satellite.
M.W.R.

N66-26988# Max-Planck-Institut für Aeronomie, Lindau uber Northeim (West Germany). Institut für Stratosphärenphysik.
X-RAY MEASUREMENTS IN THE AURORAL ZONE FROM JULY TO OCTOBER 1964
G. Kremser, E. Keppler, A. Bewersdorff, K. H. Saeger, A. Ehmert et al *In* Kiruna Geophys. Obs. Balloon-borne Meas. of Solar Ionizing Radiation 31 Oct. 1965 115 p refs Prepared jointly with Kiruna Geophys. Obs. and Lab. de Phys. Cosmique (See N66-26986 15-29) CFSTI: HC $26.10/MF $1.50

X-ray bursts and other phenomena were recorded during radiation measurements of the auroral zone made by tetrahedron-type balloons with a variety of detection instruments. Solar activity and its terrestrial effects are reported, details of each of the launchings are given, and the radiation measurements are presented in graphical form. M.W.R.

N66-27013# San Andres Univ., La Paz (Bolivia).
SCIENTIFIC CONTRIBUTIONS OF SPACE PHYSICS GROUP
[1965] 114 p refs
CFSTI: HC $4.00/MF $0.75

CONTENTS:

1. SOLAR DAILY VARIATION RECORDED AT A LOW LATITUDE STATION BY EAST AND WEST POINTING TELESCOPES DURING A PERIOD OF MAXIMUM AND MINIMUM IN SOLAR ACTIVITY H. S. Ahluwalia, V. I. Escobar, M. Zubieta, R. Anda, M. Schreier et al p 1–9 refs (See N66-27014 15-29)

2. CHARACTERISTIC EFFECTS OF THE DEFORMED MAGNETIC FIELD OF THE EARTH ON MEDIUM ENERGY COSMIC RAYS K. G. McCracken (Southwest Center for Advanced Studies) and H. S. Ahluwalia p 10–31 (See N66-27015 15-29)

3. A CASE OF TRANSIENT ANISOTROPY DURING THE RECOVERY PHASE OF A FORBUSH DECREASE H. S. Ahluwalia p 32–60 refs (See N66-27016 15-29)

N66-27014# San Andres Univ., La Paz (Bolivia).
SOLAR DAILY VARIATION RECORDED AT A LOW LATITUDE STATION BY EAST AND WEST POINTING TELESCOPES DURING A PERIOD OF MAXIMUM AND MINIMUM IN SOLAR ACTIVITY
H. S. Ahluwalia, V. I. Escobar, M. Zubieta, R. Anda, M. Schreier et al *In its* Sci. Contrib. of Space Phys. Group [1965] p 1–9 refs Presented at the 9th Intern. Conf. on Cosmic Rays, London, 6–17 Sep. 1965 Submitted for Publication (See N66-27013 15-29) CFSTI: HC $4.00/MF $0.75
(Grant AF-AFOSR-319-64)

We have examined the characteristics of solar daily variation recorded by east and west pointing directional telescopes at Mt. Chacaltaya (alt.=5200 m, geomag. lat.=−4.8°) during the years of maximum (1958) and minimum (1964) in solar activity in the last solar cycle. We find that the amplitude of the diurnal component, both in the east as well as in west directions, is reduced in 1964 compared to its value in 1958. The time of maximum of the diurnal component in the two directions has, however, the same value in the two years within errors of observations. The results of diurnal component are compared with those obtained with neutron monitors, at other equatorial mountain level stations of Huancayo and Mt. Norikura for the same period as well as with the parameters defining the diurnal component at Huancayo in the years 1937 to 1964 as obtained by an ion chamber. We come to the conclusion that the basic periodicity in the parameters defining the diurnal component of solar daily variation is of 22 years rather than of 11 years. Author

N66-27015# San Andres Univ., La Paz (Bolivia).
CHARACTERISTIC EFFECTS OF THE DEFORMED MAGNETIC FIELD OF THE EARTH ON MEDIUM ENERGY COSMIC RAYS
H. S. Ahluwalia and K. G. Mc Cracken (Southwest Center for Advanced Studies) *In its* Sci. Contrib. of Space Phys. Group [1965] p 10–31 Presented at the COSPAR Meeting, Mar del Plata, May 1965 Submitted for Publication (See N66-27013 15-29) CFSTI: HC $4.00/MF $0.75
(Grants NsG-269-62; AF-AFOSR-319-64)

A study is presented of the characteristic effects of the deformed magnetic field on the trajectories and asymptotic directions of arrival of medium energy cosmic rays at three representative stations: Chacaltaya, Deep River, and London. For this purpose we have used spherical harmonic description of the deformed magnetic field given by Mead (1964) and we have superposed this on a Stormer Dipole, and Finch and Leaton higher degree simulation field configurations. We find that asymptotic directions of arrival for deformed fields are considerably different from those for undisturbed fields at lower rigidities and the mean deviation at each station is larger for night than for day hemisphere. We also have evidence of a strong modulation of penumbral bands by the deformed field. There is an indication that small semidiurnal component, at equatorial stations, results from the deformation of the terrestrial field. The resulting component is however, an order of magnitude smaller than that observed on many occasions at low latitude stations. Author

N66-27016# San Andres Univ., La Paz (Bolivia).
A CASE OF TRANSIENT ANISOTROPY DURING THE RECOVERY PHASE OF A FORBUSH DECREASE
H. S. Ahluwalia *In its* Sci. Contrib. of Space Phys. Group [1965] p 32–60 refs Presented at the 9th Intern. Conf. on Cosmic Rays, London, 6–17 Sep. 1965 Submitted for Publication (See N66-27013 15-29) CFSTI: HC $4.00/MF $0.75
(Grants NsG-269-62; AF-AFOSR-319-64)

On July 18, 1959 a short-lived highly anisotropic cosmic ray increase was observed by some of the I.G.Y. network of recording stations during recovery from the third of the series of three closely spaced Forbush decreases. Characteristic features and the solar and terrestrial relationships of this increase are studied. Mechanisms proposed thus far for this increase are critically examined. Arguments are presented to the effect that this could not be a solar flare-type increase. It is suggested that this increase was probably produced by galactic cosmic rays which got reflected from receding blast wave and co-rotating shock wave formed during the explosive heating of solar corona following the west limb 3+ solar flare of July 16, 1959. We have studied the corresponding features of associated heliophysical, geophysical, and cosmic ray phenomena and we thereby derive the velocity of the blast wave to be 1700 Km/s and its total thickness to be about 0.14 A.U. Also we are led to believe that this blast wave had considerable fine structure built into it. We have some evidence that this blast wave probably started to dissolve into background solar wind at a distance of about 1.8 A.U. from the sun. Author

N66-27028*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

LOW ENERGY ELECTRONS IN THE DARK MAGNETOSPHERE

P. Serlemitsos (Ph.D Thesis—Md. Univ.) Aug. 1965 34 p refs Submitted for Publication

(NASA-TM-X-56886) CFSTI: HC $2.00/MF $0.50 CSCL 20H

A number of observations on satellite data are presented which pertain to low-energy (~100 keV) electrons in the dark magnetosphere and which were obtained with a scintillation counter aboard Explorer XIV. It is shown that the trapping region near the magnetic midnight meridian and at low magnetic latitudes extends on quiet days to distances in excess of 12 R_e. The extent of this region and the morphology of electrons near its outer boundary are shown to have a pronounced dependence on geomagnetic activity. Electrons trapped in the distant geomagnetic field are shown to have a pitch-angle distribution whose maximum is along the field lines and which undergoes a 90 degree change through a region of near isotropic electron fluxes, generally located at about 7 to 8 R_e near the equatorial plane. Evidence is presented to the effect that the distant field as deduced from the anisotropic features of trapped electrons is highly distorted having an almost radial appearance and showing a tendency to align itself along the earth–sun direction. Author

N66-27032*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE LOW ENERGY SPECTRUM OF COSMIC RAYS AS AN INDICATOR OF PRIMARY SOURCE CHARACTERISTICS AND INTERSTELLAR PROPAGATION

V. K. Balasubrahmanyan, E. Boldt, and R. A. R. Palmeira 21 Jun. 1965 25 p refs Submitted for Publication

(NASA-TM-X-55231; X-611-65-249) CFSTI: HC $1.00/MF $0.50 CSCL 20H

The low energy spectra of protons and helium nuclei, recently measured by McDonald and Ludwig, and by Fan, Gloeckler and Simpson, are corrected herein for solar modulation and diffusive passage through interstellar matter. The resulting source spectrum is exhibited and compared with the spectrum of accelerated particles inferred from high energy data. This analysis yields a transmission function for the source environment which is similar in form to the velocity dependent solar modulation of low energy particles. Author

N66-27078*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

LOW ENERGY ELECTRONS MEASURED ON IMP II

G. P. Serbu and E. J. R. Maier Jan. 1966 60 p refs Submitted for Publication

(NASA-TM-X-55464; X-615-66-92) CFSTI: HC $3.00/MF $0.50 CSCL 20H

The integral spectrum for low energy electrons has been measured with detailed definition of temperature and number density throughout the IMP II orbit. Electrons are found to have a Maxwellian distribution at energies below 2.0 eV with a component of higher energy. The electron temperature typically increases from above the ionosphere as the square of the radial distance, whereas the number density decreases approximately as the inverse cube of the distance out to 5 earth radii. From 5 earth radii to 15.9 R_e (apogee) the temperature remains between 1.0 and 2.0 eV and the number density remains between 25 and 50 electrons/cm^{-3}. The location of the magnetopause is not evident in the low energy electrons; however, a small temperature increase is noted at the shock boundary. An intensity increase is noted in the energetic electron component in the magnetosheath. Data for a six month period covering a 180° sector of the earth's environment is reported on. Author

N66-27180*# LTV Aerospace Corp., Dallas, Tex. LTV Astronautics Div.

ANALYSIS OF POLAR CAP ABSORPTION EVENTS. II: TIME RELATION OF MAJOR FLARES AND RF EMISSIONS AT CENTIMETER WAVELENGTHS First Quarterly Report

Fred C. Jonah 6 May 1966 43 p refs *Its* Rept.-00.802 (Contract NAS9-4911)

(NASA-CR-65370) CFSTI: HC $2.00/MF $0.50 CSCL 20H

Importance 3 and 3+ flares (in the McMath–Hulbert working list) observed during the years 1954 through 1963 were analyzed. A table of these flares including the McMath plage number and plage age in rotations, the Mt. Wilson sunspot number, the Mt. Wilson magnetic classification, the sunspot area, and the Zurich classification for the flare day is given. Also tabulated are flares of importance 3 and 3+ that were followed by an important PCA event and those not followed by a known PCA event. The relationship of the flares to all known radio frequency emissions at 1500, 2000, 2800, 2980, 3000, and 3750 Mc/s that occurred at the time of the flare was studied. The area and magnetic classification of sunspot groups on the flare day, and the age of the associated plage region in solar rotations were also considered. The results are presented in tabular form. L.S.

N66-27189*# National Aeronautics and Space Administration, Washington, D. C.

THE MAGNETIC FIELD STRUCTURE AND ITS VARIATIONS IN THE SOLAR FLARE REGION [STRUKTURA MAGNITNYKH POLEY I YEYE IZMENENIYA V RAYONE SOLNECHNYKH VSPYSHEK]

S. I. Gopasyuk, M. B. Ogiri, A. B. Severnyy, and Ye. F. Shaposhnikova Apr. 1964 83 p refs Transl. into ENGLISH from Izv. Krymsk. Astrofiz. Observ. (Moscow), v. 29, 1963 p 15–67

(NASA-TT-F-8724) CFSTI: HC $3.00/MF $0.75 CSCL 20H

In 51 cases a study has been made and models have been constructed of the configurations and magnetic fields in spot groups, before and after a flare, for 4 classes of flares. Class I includes proton flares of importance 3 and 3+, which were responsible for a cosmic ray increase effect recorded on balloons. Flares producing this effect at ground level are included in this class. Class II includes proton flares of importance 3 and 3+. No effect was recorded on balloons, but the flares were responsible for absorption in the polar cap. Class III includes flares of importance 3 and 2+. No geophysical effects were observed. Class IV includes flares of importance 2 and 2+. Author

N66-27199*# National Aeronautics and Space Administration, Washington, D. C.

ON THE RADIO AND X-RAY EMISSION OF SOLAR FLARES [O RADIOIZLUCHENII I RENTGENOVSKOM IZLUCHENII SOLNECHNYKH VSPYSHEK]

A. K. Pankratov Apr. 1964 23 p refs Transl. into ENGLISH from Izv. Krymsk. Astrofiz. Observ. (Moscow), v. 29, 1963 p 160–174

(NASA-TT-F-8723) CFSTI: HC $1.00/MF $0.50 CSCL 20H

Data on f_{min} radio emission and solar flares, collected during the IGY and IGC by observatories and stations have been used. The connection between X-ray emission and the emission in H_α of flares is studied statistically. The absence of

a directivity effect in the X-ray emission of flares is established. It is found that all type IV bursts of radio emission are accompanied by an appreciable flow of X-ray emission, sufficient for the appearance of a well noticeable (according to f_{min}) additional ionization of the D layer. The possibility of a unique relation between the presence of X-ray emission of solar flares and type IV bursts of radio emission is discussed briefly. It is proved that several intense ionospheric effects (in the D layer) are due to the X-ray emission from behind-the-limb flares, which are seen from the earth as a subflares or not at all.
Author

N66-27200*# National Aeronautics and Space Administration, Washington, D. C.
ON ELECTRONS WITH ENERGIES GREATER THAN 1600 KeV IN THE EARTH'S RADIATION BELTS [ELEKTRONY S ENERGIYEY BOLEYE 1600 KeV V RADIATSIONNYKH ZONAKH ZEMLI]
A. I. Yershkovich Feb. 1964 9 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Geofiz. (Moscow), no. 9, 1963 p 1457–1461
(NASA-TT-F-8578) CFSTI: HC $1.00/MF $0.50 CSCL 20H

The probability that the total energy of the electron in the laboratory system $E_L \geq E_o$, if the velocity of the neutron is equal to V_o, is determined. The subscript L refers to the quantities of the laboratory system of reference. The energy of the electron is measured in units of $m_o c^2$, where m_o is the mass of the electron at rest. In terms of these units, the maximum energy associated with the origin of electrons in the C-system (system of mass center) is equal to 2.53. Results of a comparison between calculations and experimental data, in the region where the radiation of the external zone is a maximum, make it possible to assume that electrons with $E_K \geq 1,600$ KeV can be formed directly by the decay of fast neutrons in the atmosphere. Also, it is shown that the fluxes and electrons must have substantial anisotropy and that the majority of the particles move at large pitch angles at the equator.
I.v.L.

N66-27205*# Consultants and Designers, Inc., Arlington, Va.
ON THE HARDNESS OF X-RAY EMISSION OF SOLAR FLARES [O ZHESTKOSTI RENTGENOVSKOGO IZLUCHENIYA SOLNECHNYKH VSPYSHEK]
L. S. Levitskiy 23 Nov. 1963 10 p refs Transl. into ENGLISH from Izv. Krymsk. Astrofiz. Observ. (Moscow), v. 29, 1963 p 146–151
(NASA-TT-F-8643; ST-SP-10072) CFSTI: HC $1.00/MF $0.50 CSCL 04A

A method is proposed for the determination of the effective wavelength λ_{eff} of the X-ray emission of chromospheric flares at time of SID maximum. It is based on the utilization of data on minimum reflection frequencies f_{min} obtained from data of the world network of ionospheric stations. The values of λ_{eff} for seven flares were thus determined and found to be within the 2 to 3 Å range.
Author

N66-27208*# Consultants and Designers, Inc., Arlington, Va.
INVESTIGATION OF THE X-RAY EMISSION OF SOLAR FLARES BY THE RADIOASTRONOMICAL METHOD [ISSLEDOVANIYE RENTGENOVSKOGO IZLUCHENIYA SOLNECHNYKH VSPYSHEK RADIOASTRONOMICHESKIM METODOM]
Yu. I. Neshpor 26 Nov. 1965 13 p refs Transl. into ENGLISH from Izv. Krymsk. Astofiz. Observ. (Moscow), v. 29, 1963 p 152–159
(Contract NAS5-2078)
(NASA-TT-F-8644; ST-SP-10073) CFSTI: HC $1.00/MF $0.50 CSCL 20H

Study of the frequency dependence of the weakening of cosmic radio emission during sudden ionospheric disturbances results in the following conclusions: (1) the spectral distribution of the intensity of X-ray emission of solar flares is different for various flares; and (2) some flares are characterized by an appreciable increase in the intensity of X-ray emission in the short-wave region.
Author

N66-27209*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
OBSERVATIONS OF THE SOLAR WIND DURING THE FLIGHT OF IMP-1
John H. Wolfe, Richard W. Silva, and Marilyn A. Myers [1965] 66 p refs Submitted for Publication
(NASA-TM-X-56605) CFSTI: HC $3.00/MF $0.75 CSCL 20H

Solar wind and its interaction with the geomagnetic field are discussed, and the energy per unit charge and gross flow characteristics of the positive ion component of the incident plasma is measured as a function of radial distance from the earth. The IMP-I (Explorer 18) spacecraft, used with a curved plate electrostatic analyzer, was launched into a highly eccentric orbit of about 31 earth radii apogee, with an initial sun-earth-apogee angle of approximately 27° in the dawn hemisphere. Plasma observations indicate that three distinct regions of space were traversed by the satellite. The first was the geomagnetic cavity where no plasma was observed within the dynamic range of the instrument. The second was the region of turbulent plasma flow associated with the interaction between the solar wind and the geomagnetic field. The third was interplanetary space where the free streaming solar wind was observed. Data are given for the first 2-1/2 months of satellite life. The plasma data obtained in the interplanetary space revealed that the solar wind density rarely exceeded 3 ions/cm^{-3}
Author

N66-27214*# Chicago Univ., Ill. Enrico Fermi Inst. for Nuclear Studies.
OBSERVATION OF THE COSMIC RAY ELECTRON–POSITRON RATIO FROM 100 MeV TO 3 BeV IN 1964
R. C. Hartman, R. H. Hildebrand, and Peter Meyer Feb. 1965 8 p refs Submitted for Publication
(Grant NsG-144-61)
(NASA-CR-57342; EFINS-65-13) CFSTI: HC $1.00/MF $0.50 CSCL 20H

Results of an experiment carried out at balloon altitude, using modified equipment for better energy resolution, are presented. A schematic diagram of the instrument is shown. The modifications are: a gas Cerenkov counter replacing the liquid Cerenkov counter; an anticoincidence counter placed under the permanent magnet; and improvements in the fiducial system. Data were obtained from the balloon flight covering a period of 55 minutes. It was reported that the data are statistically less significant than previous data, but that the energy intervals are better defined. It was concluded that the negative excess of electrons between 100 MeV and 1000 MeV observed previously is confirmed. It was further concluded that, within the limit of statistical accuracy, the negative excess extends to at least 3 BeV, showing also that at higher energies accelerative processes are the dominant source of primary electrons.
N.E.N.

N66-27219*# Chicago Univ., Ill. Enrico Fermi Inst. for Nuclear Studies.
SOLAR MODULATION OF THE GALACTIC HELIUM SPECTRUM ABOVE 30 MeV PER NUCLEON

C. Y. Fan, G. Gloeckler, and J. A. Simpson [1965] 16 p refs Presented at Intern. Conf. on Cosmic Rays, London, 6–17 Sep. 1965 Submitted for Publication
(Contract NAS5-2900; Grant NsG-179-61; Contract AF 19-(628)-2473)
(NASA-CR-67819; EFINS-65-87) CFSTI: HC $1.00/MF $0.50 CSCL 20H

Time variations in the differential energy spectrum and flux of primary helium nuclei in the energy range 30 to 90 MeV per nucleon have been studied. Continuous measurements over most of the one-year period were made using dE/dx versus E type solid-state, charged particle telescopes which were flown on two satellites IMP-I and IMP-II which had highly eccentric orbits. The helium spectra obtained are well represented by a power dependence of the type αE^{γ} where E is the particle total kinetic energy. The exponent γ changed from 1.75 to 1.3 in the one-year period while the flux of helium increased by about 75 percent in the same time interval. Since in addition to this observed modulation, the helium nuclei were continuously present and since the spectrum extends smoothly into the higher energy spectrum measured on balloons, we are convinced that we are observing the low energy extension of the modulated local galactic helium spectrum. From the measured fractional helium intensity increases with time we are able to deduce that the modulation depends predominantly on the particle velocity.
Author

N66-27322*# Chicago Univ., Ill. Enrico Fermi Inst. for Nuclear Studies.
STABILITY OF INTERSTELLAR GAS AND FIELD INCLUDING ROTATION
I. Lerche [1966] 42 p refs
(Grant NsG 96-60)
(NASA-CR-75413; EFINS-66-48) CFSTI: HC $2.00/MF $0.50 CSCL 20H

The stability of the interstellar gas to perturbations in the gas pressure, magnetic field and cosmic ray pressure is discussed from a hydromagnetic point of view taking rotation into account. For a particular model, it is shown that the system is unstable to transverse perturbations in the sense described by Parker (1966). This result holds true for a uniformly rotating system bound in a stellar parabolic gravitational well provided only that the Coriolis acceleration is everywhere less than the stellar gravitational acceleration. The tendency for the interstellar gas to drain along the lines of force into the lowest regions of magnetic field is reduced, but not removed, by rotation. The e-folding time is of the order of the free-fall time under an effective gravity ($g - r\Omega^2$). The results are derived for a particular model, but their physical content should be of general validity for all systems. Author

N66-27422# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
MEASUREMENT OF LONG-WAVELENGTH COSMIC NOISE BY ZERO-CROSSING INTERFEROMETRIC APERTURE SYNTHESIS Final Report, Oct. 1, 1962–Sep. 30, 1965
James William Graham and Roy K. Breon 30 Dec. 1965 31 p refs
(Contract Nonr-3963(02))
(AD-630628) CFSTI: HC $2.00/MF $0.50

A unique measurement system offering the possibility of mapping cosmic radiation at 100–1000 meter wavelengths with angular resolution of approximately 1 degree is described. The system requires an orbiting satellite pair to get above the ionosphere. An aperture synthesis method with a variable radio base line involving a technique of zero-crossing spatial cross-correlation of clipped signals is described. The system offers a method of digital signal processing to achieve high angular resolution and dynamic range at low frequencies without erecting large arrays in space. The use of zero crossings in the digital signal processing permits a significant reduction in the data that must be processed in the satellite without sacrificing accuracy. The techniques described become easier est. The complexity of the system is independent of the maximum radio base line required. The techniques may be instrumented at frequencies as low as the interplanetary cutoff frequency at about 50 kc/sec. Author (TAB)

N66-27487*# National Aeronautics and Space Administration, Washington, D. C.
RADIATION SAFETY DURING SPACE FLIGHTS
V. G. Bobkov, V. P. Demin, I. B. Keirim-Markus, Ye. Ye. Kovalev, A. V. Larichev et al May 1966 422 p refs Transl. into ENGLISH of the book "Radiatsionnaya Bezopasnost pri Kosmicheskikh Poletakh" Moscow, Atomizdat., 1964
(NASA-TT-F-356) CFSTI: HC $7.00/MF $2.25 CSCL 18F

Investigations made into the radiation dangers incurred during manned space flights are discussed in detail. The dosimetry of cosmic radiation is considered, including the effects of ionizing radiation on human beings. The origin of primary galactic radiation, its interaction with the earth's magnetic field, and the tissue dose rate resulting from it are reviewed, and radiation levels measured during manned Soviet space flights are given. The frequency, mechanism, and methods of forecasting solar cosmic radiation are discussed, and the inner radiation zone of the earth is examined. The earth's outer radiation zone, mapped by Soviet and American satellites, is covered and the spectrum, structure, and resulting tissue dose are presented. The protons which comprise the main part of corpuscular radiation from solar cosmic radiation are considered, and the shielding of manned spacecraft from these protons is discussed. Shielding from electrons and electromagnetic radiation for flights near the earth is treated, and the radiation from nuclear engines and other nuclear power devices is discussed. Additionally, shielding problems for space vehicles having a nuclear reactor are examined. H.S.W.

N66-27649# Sacramento Peak Observatory, Sunspot, N. Mex.
HE I EXCITATION IN CHROMOSPHERIC FLARES
N. V. Steshenko and V. L. Khokhlova [1963] 25 p refs Transl. into ENGLISH from Izv. Krymak. Astrofiz. Observ. (USSR) v. 27, 1962 p 120–129 *Its* Solar Res. Note 35 Supersedes AD-413917
(AFCRL-63-277; AD-621195; AD-413917) CFSTI: HC $1.00/MF $0.50

The study of 11 emission lines of parahelium and orthohelium in the flare of August 30, 1959, and also several lines in other flares, shows that the optical depth of the helium lines is small in the wavelength region λλ3700–6700Å of flares observed on the solar disk and at the limb. The population of excited He I levels is derived from the energy of the lines, taking into account the optical depth of non-transparent lines. The line-widths are used for obtaining the upper limit of kinetic temperature in the He I emission region, assuming that line broadening is due only to the thermal velocities of the atoms. The population of the He I levels is computed theoretically. For this purpose the statical equilibrium equations and that of ionization equilibrium are solved for parahelium and orthohelium together. It is shown that excitation by electron impact and recombination can be provided for the observed emission. The possibility of heating of the optical

emission region of the flare due to the absorption of X-ray radiation of the flare is considered. The observed flux of X-ray radiation and the energy output of the flare in the ultraviolet and visual spectral regions can be provided for if the color temperature of the core of the flare is $\sim 5 \times 10^{6}$° K.
Author (TAB)

N66-27765# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.
LARGE AREA UNIFORM ELECTRON BEAMS FOR SPACE RADIATION ENVIRONMENTAL STUDIES
Anthony J. Favale Mar. 1966 26 p refs Presented at the Inst. of Environ. Sci. Ann. Meeting, San Diego, Calif., 4 Apr. 1966
(RM-317J)

A technique has been developed that provides unscanned large area uniform electron beams for space radiation environmental studies. With this technique, beam uniformities of better than 4 parts per 100 have been demonstrated with an electron beam whose beam divergence half angle is 7.5°. The technique has been used to study the effects of "Starfish" radiation (man-made electron radiation belt produced by U.S. high altitude nuclear bomb tests in 1962) on the NASA/Goddard Orbiting Astronomical Observatory Star Trackers, on the two atmospheric airglow experiments aboard NASA/Goddard Orbiting Geophysical Observatory, and on isolated RCA 1P21 photomultiplier tubes. The results of these tests, which agreed with the data that have been received from the presently orbiting OGO, show that the simulated radiation environment induces noise in the photomultiplier tubes present in all of these subsystems.
Author

N66-27926*# California Univ., La Jolla. Dept. of Physics.
THE SPECTRUM OF CRAB NEBULA X-RAYS TO 120 KeV
Laurence E. Peterson, Allan S. Jacobson, and R. M. Pelling 21 Dec. 1965 40 p refs Submitted for Publication
(Grant NsG-318)
(NASA-CR-75652; UCSD-SP-65-6) CFSTI: HC $2.00/MF $0.50 CSCL 20H

An NaI crystal detector was used in a balloon determination of the Crab Nebula X-ray spectrum over the range of 16 to 120 keV. The peak counting rate noted on ascent is attributed to cosmic ray maximum. Rate increase at lower energies as the balloon approaches ceiling is apparently due to a diffuse component of cosmic photons which contributes almost one-half of the measured background in the 20 to 50 keV range; cosmic ray production in the overlaying atmosphere contributes approximately the other half; and only about five to 10% is considered true detector background. The increase near the end of the flight is attributed to the meridian passage of an X-ray source. Pulse height distribution of the background and of the Crab during transit are also shown; and the incident flux is obtained by subtracting these spectra and correcting for atmospheric absorption, efficiency, deadtime, channel width, and geometry factor. There are no statistically significant fluxes above background at greater than 120 keV, and atmospheric absorption removes all X-rays below 16 keV. The index of the differential energy flux over the range studied was found to be $0.91 \pm .10$.
M.W.R.

N66-27972# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.
ESTIMATES ON THE NEUTRON FLUX ON THE SURFACE OF THE MOON INDUCED BY SOLAR FLARES
Martin S. Spergel May 1966 24 p refs Presented at Ann. Meeting of Am. Geophys. Union, Washington, 19-22 Apr. 1966 Submitted for Publication
(RE-263J)

A theoretical calculation has been performed on the production, by solar flare protons, of neutrons within the lunar surface and the resulting neutron albedo flux at the lunar surface. The transport of the neutrons is approximated by a single, energy independent, exponential attenuation function. Effective neutron attenuation length is taken as the sum of the inelastic neutron scattering length and a fraction of the elastic neutron scattering length. The resulting neutron energy distribution will necessarily have the form of the production spectrum, which is that of the nuclear evaporation model. The incident solar flare proton flux is represented by an exponential rigidity spectrum. Ionization losses for the incident solar protons are calculated from estimates of the range of the protons within the lunar surface. The lunar medium is represented by an "average" chondritic material. The resulting neutron albedo is found for three different flares and for various values of the model's parameters.
Author

N66-28025*# Cornell Univ., Ithaca, N. Y. Center for Radiophysics and Space Research.
ADIABATIC INVARIANT TRAPPED RADIATION SHELLS AND COSMIC RAY CUTOFFS IN MODELS OF THE MAGNETOSPHERE DISTORTED BY THE SOLAR WIND PLASMA
A. B. Friedland Mar. 1966 119 p refs
(Grant NsG-382)
(NASA-CR-75563; CRSR-231) CFSTI: HC $4.00/MF $0.75 CSCL 20H

Dr. Ernest Ray has found an approximate first integral for the motion of charged particles in static magnetic fields not necessarily displaying axial symmetry. This involves a canonical transformation to a new set of coordinates, one of which is approximately ignorable. In field models which approximately preserve this new kind of symmetry, of which the geomagnetic field is an example, a perturbation technique is here employed to derive an improved version of Ray's first integral. In the technique, conservation of energy, adiabatic invariance of the magnetic moment, Ray's first integral, and the slow drift motion of the particles under consideration are used as the zeroth order solution. The resulting quadrature predicts the splitting of magnetic shells in field models which do not display axial symmetry. This result was first suggested by Stone but is unsatisfactorily described by the McIlwain "L" parameter for models of the earth's field which are severely distorted because of the "Solar Wind Plasma". The improved first integral is further used to derive a new method for calculating Cosmic Ray cut-offs at the surface of the earth. This method replaces the traditional Stormer theory and its refinements put forward by other authors.
Author

N66-28066# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
RADIO-FREQUENCY EMISSION FROM HYDROXYL IN GALACTIC SOURCES
A. H. Cook 9 May 1966 74 p refs
(JILA-67)

The outstanding features of observations of 18-cm radiation from OH near H II regions are summarized. It is argued that they can be accounted for only if stimulated emission occurs and if the sources lie in the ionization front around the H II region. An analysis of a model based on these ideas shows no obvious inconsistency and may in addition be able to account for the large differences between the spectra of

the four hyperfine components of the A-doublet line involved. Ways of producing OH in the shock front are discussed, and a previously suggested optical pumping mechanism for inverting the populations of the levels of the A-doublet (Cook, 1966) is further examined. Author

N66-28085*# Southwest Center for Advanced Studies, Dallas, Tex.
COSMIC RAY TABLES: SYMPTOTIC DIRECTIONS, VARIATIONAL COEFFICIENTS AND CUT-OFF RIGIDITIES IQSY Instruction Manual No. 10
K. G. Mc Cracken, U. R. Rao, B. C. Fowler, M. A. Shea, and D. F. Smart (AFCRL) London, IQSY Comm., May 1965 200 p refs
(Grants NsG-269-62; NSF GP-926)
(NASA-CR-75779) CFSTI: HC $5.00/MF $1.25 CSCL 20H

Cosmic ray vertical cut-off rigidities, asymptotic directions, and variational coefficients are discussed and the data is presented in tabular form. Previously obtained data were augmented for eight directions inclined to the vertical. The basic mathematical formulas, the trajectory determinations, and the magnetic field specifications are given. The asymptotic cone of acceptance, and the variational coefficients and their evaluation and application to the diurnal variation are described. The tables included are (1) Finch and Leaton coefficients used in the asymptotic direction calculations; (2) list of stations, locations, and cut-off rigidities; (3) cosmic ray asymptotic directions; and (4) comsic ray variational coefficients. N.E.N.

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N66-26896* Smithsonian Astrophysical Observatory, Cambridge, Mass.
SMITHSONIAN ASTROPHYSICAL OBSERVATORY STAR CATALOG. POSITIONS AND PROPER MOTIONS OF 258,997 STARS FOR THE EPOCH AND EQUINOX OF 1950.0. PART 1: STARS 000-001-073-708 (BANDS +80° TO +30°)
Washington, Smithsonian Inst., 1966 809 p refs Part 1 of 4 Parts *Its* Publ.-4652
(Grant NsG-87-60)
(NASA-CR-75428) GPO: HC $20.00(per set only); CFSTI: MF $4.00 CSCL 03B

The compilation, which is presented in four volumes, gives positions and proper motions for 258,997 stars, having an average distribution of six stars per square degree. The star positions have an average standard deviation of 0".2 at their original epochs (0".5 at epoch 1963.5). The equinox is 1950.0, and the frame of reference is that of the FK 4. The following information is given for each star: right ascension (α_{1950}) and declination (δ_{1950}) for equator, equinox, and epoch 1950.0; standard deviation (σ) of the position at epoch 1950.0; right ascension (α_2) and declination (δ_2) from the equator and equinox 1950.0, at the mean epoch of the original observations (in seconds only); standard deviations (σ,σ') of α_2 and δ_2; mean epochs (t_2, $2_2'$) of the original observations in right ascension and declination; annual proper motions for right ascension (μ) and declination (μ'); standard deviations (σ) of μ and μ'; visual magnitude (for 99% of the stars); photographic magnitude (for 50% of the stars); Durchmusterung number (BD, CD, CPD); source catalog; and star number (from source catalog). In addition, the methods of reduction are described and discussed; and the original source catalogs are listed. D.T.

N66-26897*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
SMITHSONIAN ASTROPHYSICAL OBSERVATORY STAR CATALOG. POSITIONS AND PROPER MOTIONS OF 258,997 STARS FOR THE EPOCH AND EQUINOX OF 1950.0. PART 2: STARS 073-709-128-547 (BANDS +20° TO +0°)
Washington, Smithsonian Inst., 1966 599 p Part 2 of 4 Parts *Its* Publ.-4652 For abstract see N66-26896 15-30
(Grant NsG-87-60)
(NASA-CR-75429) GPO: HC $20.00(per set only); CFSTI: MF $2.75 CSCL 03B

N66-26898*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
SMITHSONIAN ASTROPHYSICAL OBSERVATORY STAR CATALOG. POSITIONS AND PROPER MOTIONS OF 258,997 STARS FOR THE EPOCH AND EQUINOX OF 1950.0. PART 3: STARS 128-548-192-333 (BANDS −0° TO −20°)
Washington, Smithsonian Inst., 1966 680 p Part 3 of 4 Parts *Its* Publ.-4652 For abstract see N66-26896 15-30
(Grant NsG-87-60)
(NASA-CR-75430) GPO: HC $20.00(per set only); CFSTI: $3.25 CSCL 03B

N66-26899*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
SMITHSONIAN ASTROPHYSICAL OBSERVATORY STAR CATALOG. POSITIONS AND PROPER MOTIONS OF 258,997 STARS FOR THE EPOCH AND EQUINOX OF 1950.0. PART 4: STARS 192-334-258-997 (BANDS −30° TO −80°)
Washington, Smithsonian Inst., 1966 721 p Part 4 of 4 Parts *Its* Publ.-4652 For abstract see N66-26896 15-30
(Grant NsG-87-60)
(NASA-CR-75431) GPO: HC $20.00(per set only); CFSTI: MF $3.50 CSCL 03B

N66-26954# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.
THE EXPLOITATION OF LUNAR NATURAL RESOURCES
S. Penn Dec. 1965 31 p refs Submitted for Publication
(RM-305J)

The possibility of there existing resources or materials on the moon which are valuable to man, and the further possibility of mining these resources are discussed. Included in this discussion are detailed hypothetical considerations of lunar surface texture and petrology, and lunar water resources. In addition, various electric power systems are examined for potential applicability in the exploration of the moon; and several methods are proposed for mining. D.T.

N66-26955# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.
EXPERIMENTAL ASPECTS OF COMMINUTION IN VACUUM
G. Mohr Mar. 1966 32 p refs
(RM-313)

Past theoretical and experimental work in conventional crushing and grinding of particles is examined in order to determine its applicability to comminution experiments in ultra-high vacuum. Furthermore, in the absence of precedents for the suggested investigation, the experimental aspects of the investigation are discussed. Notwithstanding the initial difficulties, the newly developed experimental techniques may open up new avenues to more comprehensive studies of surface formation and behavior at very low pressures. Or they may

be used to complement existing experimental procedures that have been severely limited by the fact that the materials under study had to be produced under earth-ambient conditions prior to investigation. Author

N66-26980# Boeing Scientific Research Labs., Seattle, Wash.
GEO-ASTROPHYSICS LABORATORY REVIEW, JULY-DECEMBER 1965
John C. Noyes et al [1965] 31 p refs

The results of research in the areas of photoionization, mass spectrometry and molecular beams are summarized. Analyses of lunation data resulted in statistical distributions of albedo values and surface brightness temperatures. It is reported that significant departures, from earlier conclusions, of radial temperature variation have been found. A statistical treatment of the motion of charged particles in a random field showed that under certain conditions the particles may mirror and thus perform a random walk without experiencing any strong discontinuities in the magnetic field. A separate study demonstrated that neutrons from solar flares cannot be detected by looking for their decay product protons near the earth. This is attributed to the fact that the decay protons become indistinguishable from primary flare protons after both diffuse through the interplanetary magnetic field. H.S.W.

N66-26981# Princeton Univ. Observatory, N. J.
LINE SPECTRA OF DELTA AND PI SCORPII IN THE FAR ULTRAVIOLET
Donald C. Morton and Lyman Spitzer, Jr. 12 Oct. 1965 28 p refs

Three Aerobee rockets were launched to obtain stellar ultraviolet line spectra using two objective spectrographs. One corrector was quartz and the other calcium fluoride. Most of the films obtained were totally fogged, but underdeveloping one from the calcium-fluoride camera showed wide spectra of the early B type stars δ and π Scorpii with a resolution of about 1 Å. The spectra extend from 1260 to 1720 Å for δ and from 1260 to 2180 for π. Many lines are visible in both spectra, all in absorption. Wavelengths are given here for 29 lines, of which 12 are common of both spectra. Identifications include CII at 1335, SiIV at 1394 and 1403, CIV at 1549, HeII at 1640 Å, and probably a number of features due to CIII multiplets. The spectra are too weak to permit any useful intensity calibration, but in general they seem to be consistent with the latest models now available for these stars. Author

N66-26991# Padua Univ. (Italy).
CONTRIBUTIONS OF THE ASTROPHYSICS OBSERVATORY OF THE UNIVERSITY OF PADUA IN ASIAGO [CONTRIBUTI DELL'OSSERVATORIO ASTROFISICO DELL'UNIVERSITA DI PADOVA IN ASIAGO]
1965 81 p refs In ITALIAN and ENGLISH *Its* No. 170-176 CFSTI: HC $3.00/MF $0.75

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3. THE ROTATION AND MASS OF NGC 3310 F. Bertola p 35-43 refs (See N66-26994 15-30)
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5. SPECTROSCOPIC AND PHOTOGRAPHIC OBSERVATIONS OF SUPERNOVAE F. Bertola, A. Mammano, and M. Perinotto p 51-61 refs (See N66-26996 15-30)
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N66-26992# Padua Univ. (Italy).
VARIABLE STARS OF CLUSTER NGC 5024 (M 53). II: STUDY OF THE VARIABLES N. 1, 2, 3, 7, 8, 11, 12, 26, 26, 27, 35, 38 [LE STELLE VARIABILI DELL'AMMASSO NGC 5024=M 53. II: STUDIO DELLE VARIABILI N. 1, 2, 3, 7, 8, 11, 12, 26, 26, 27, 35, 38]
Rino Margoni *In its* Contrib. of the Astrophys. Obs. of the Univ. of Padua in Asiago. 1965 p 3-27 refs In ITALIAN; ENGLISH Summary (See N66-26991 15-30) CFSTI: HC $3.00/MF $0.75

A further analysis of 172 plates secured between 1961 and 1963 with the Asiago 122 cm reflector allows up to improve the periods of twelve more RR Lyrae variables. For nine of these stars it is possible to infer secular changes of the periods. Light curves and secular variations are given. Author

N66-26993# Padua Univ. (Italy).
FURTHER OBSERVATIONS OF THE SUPERNOVA IN NGC 1058
F. Bertola *In its* Contrib. of the Astrophys. Obs. of the Univ. of Padua in Asiago 1965 p 29-33 refs (See N66-26991 15-30) CFSTI: HC $3.00/MF $0.75

Three years of photographic observations of the supernova discovered in 1961 near NGC 1058 and some UBV determinations of magnitude at the epoch of the main outburst are presented. Author

N66-26994# Padua Univ. (Italy).
THE ROTATION AND MASS OF NGC 3310
F. Bertola *In its* Contrib. of the Astrophys. Obs. of the Univ. of Padua in Asiago 1965 p 35-43 refs (See N66-26991 15-30) CFSTI: HC $3.00/MF $0.75

The galaxy NGC 3310 has been investigated spectroscopically for rotation. It has been found that the line of nodes is coincident with the major axis of the inner and outer regions. The density within 492 pc, derived assuming as a model an homogeneous spheriod, is $\rho = 1.44 \cdot 10^{-21}$ gr/cm^3 and the corresponding mass $4.21 \cdot 10^{42}$ gr = 2.1 $10^9 M_\odot$. The mass of light ratio in the region studied is $M/L_{pg} \sim 1$. Author

N66-26995# Padua Univ. (Italy).
SOME OBSERVATIONS ON THE VARIABILITY OF V SAGITTAE [ALCUNE OSSERVAZIONI SULLA VARIABILITA DI V SAGITTAE]
G. Romano *In its* Contrib. of the Astrophys. Obs. of the Univ. of Padua in Asiago 1965 p 45-50 refs In ITALIAN; ENGLISH Summary (See N66-26991 15-30) CFSTI: HC $3.00/MF $0.75

Photographs of V Sge taken in the years 1956-1958 have been re-examined on the hypothesis that the star is an eclipsing binary. The elements of this star have been slightly changed. This work confirms the conclusions obtained by Herbig, Preston, Smak and Paczynski. Author

N66-26996# Padua Univ. (Italy).
SPECTROSCOPIC AND PHOTOGRAPHIC OBSERVATIONS OF SUPERNOVAE
F. Bertola, A. Mammano, and M. Perinotto *In its* Contrib. of the Astrophys. Obs. of the Univ. of Padua in Asiago 1965 p 51-61 refs (See N66-26991 15-30) CFSTI: HC $3.00/MF $0.75

The light curves of the supernovae in NGC 1084 and 3938 (1964) and some photographic observations of the supernovae in NGC 3003 and 5905 are given in this papsr. The spectroscopic analysis of the supernova in NGC 1084 shows that the star belongs to type I, while that in NGC 3938 has to be considered of type I peculiar. Author

N66-26997# Padua Univ. (Italy).
THE C-M DIAGRAM OF THE GLOBULAR CLUSTER M 56
R. Barbon *In its* Contrib. of the Astrophys. Obs. of the Univ. of Padua in Asiago 1965 p 63-79 refs (See N66-26991 15-30) CFSTI: HC $3.00/MF $0.75

In the present work the c-m diagram of the globular cluster M 56 based on the two-color photographic photometry of about 340 stars in and near the cluster, is given. A new determination of reddening and distance is also obtained. Author

N66-26998# Padua Univ. (Italy).
STELLAR POPULATIONS AND SUPERNOVAE
F. Bertola and M. S. Sussi *In its* Contrib. of the Astrophys. Obs. of the Univ. of Padua in Asiago 1965 p 81-85 refs (See N66-26991 15-30) CFSTI: HC $3.00/MF $0.75

The association to stellar populations of type I and II supernovae has been analyzed, taking into account the morphological types of the parent galaxies and the spatial distribution. The membership of supernovae II to population I is confirmed. Two frequency maxima for type I supernovae in correspondence of E and S(B)c galaxies and the spatial distribution within spiral galaxies suggest that very probably two kinds of type I supernovae, belonging to population I and II respectively, exist. Author

N66-27006*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VIBRATIONS OF THE UNIVERSE
E. R. Harrison Mar. 1966 90 p refs Submitted for Publication
(NASA-TM-X-55477; X-641-66-103) CFSTI: HC $3.00/MF $0.75 CSCL 03B

The aim is to review and extend our knowledge of the time dependence of fluctuations in density in homogeneous and isotropic models of the universe. Perturbations are assumed to be small and a linearized, normal mode analysis is used. Only gravitational interactions and irrotational motions are considered. Using first Newtonian and then general relativity theory it is shown that the amplitude of various modes increases in expanding and contracting models of the universe. The origin and growth of celestial structure require that uniform models of the universe are unstable against arbitrarily small perturbations. However, the rate of growth of the various modes, particularly in an expanding universe, is sufficiently slow to cast doubt on the instability of the models. A linearized gravitational theory appears inadequate to account for the origin of structure in the universe; hence alternative explanations must be found. Author

N66-27026*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MEASURED VELOCITIES OF INTERPLANETARY DUST PARTICLES
C. S. Nilsson, W. M. Alexander, C. W. Mc Cracken, O. E. Berg, and L. Secretan [1965] 6 p Submitted for Publication
(NASA-TM-X-56746) CFSTI: HC $1.00/MF $0.50 CSCL 22B

The instrument flown on the OGO I satellite and data from three probable impacts are briefly described. The detector array, consisting of four tubular detectors, and the detectors' positions and functions are mentioned. The paucity of data required a careful statistical analysis. It was concluded that the first two impacts had velocities in the range of 30-50 km/sec, and probably were in high eccentricity heliocentric orbits. The third impact was considered to have a much lower velocity and to be in a low eccentricity orbit or a closed geocentric orbit. Details of the three impacts are tabulated. N.E.N.

N66-27039*# International Business Machines Corp., Owego, N. Y. Space Guidance Center.
SUMMARY OF RESULTS OF ENGINEERING RESEARCH PROGRAM FOR MANNED EARTH-ORBITAL MISSIONS
Washington, NASA, Aug. 1965 25 p
(Contract NAS1-4667)
(NASA-CR-66018; IBM-65-928-63) CFSTI: HC $1.00/MF $0.50 CSCL 22A

This report summarizes the approach taken and the results obtained from a study of an engineering research experiment program for manned earth-orbital missions. Planned and contemplated NASA space missions were examined, and key missions or programs identified as encompassing the major technological problems associated with the entire space program. The final engineering experiment program was obtained from a detailed analysis of these problems and experiments. The data generated basically consist of engineering problem and experiment description, and the experiment program. C.T.C

N66-27045*# California Inst. of Tech., Pasadena.
NEUTRON STARS. I: PROPERTIES AT ABSOLUTE ZERO TEMPERATURE
John N. Bahcall and Richard A. Wolf [1965] 24 p refs Submitted for Publication
(Grant NGR-05-002-028; Contract Nonr-220(47))
(NASA-CR-67872) CFSTI: HC $1.00/MF $0.50 CSCL 03B

The properties of a neutron star at absolute zero temperature are discussed. The problem of determining the ground state of a neutron star is formulated in a general way and the conditions are described under which one might reasonably hope that an individual particle model (which we adopt) is valid. The effects of the strong interactions on the number densities and production thresholds of the various hadrons are illustrated with several examples. The modification of the energy spectrum of neutrons and protons in a neutron star is calculated using an effective mass approximation adapted from the theory of nuclear matter. Crude estimates are made of the contributions of hadrons other than nucleons to the equation of state and specific heat. Author

N66-27048*# General Dynamics/Convair, San Diego, Calif.
VISIBILITY IN SPACE: TARGET DESCRIPTION SUBROUTINE

J. T. Neu, R. S. Dummer, W. T. Breckenridge, Jr., and John Geanacou [1966] 90 p refs
(Contract NAS9-4814)
(NASA-CR-65369; GD/C-DBE-66-004) CFSTI: HC $3.00/MF $0.75 CSCL 22A

This report presents the description of a computer subroutine for use in calculating the visibility of the Lunar Excursion Module (LEM) ascent stage during the moon orbit rendezvous with the Command Service Module (CSM). The computer technique described here is however generally applicable with minor modification to the problem of spacecraft visibility. The subroutine makes use of bi-directional reflectance data for designated LEM materials to compute the illumination of the observer by LEM reflected light. The subroutine considers direct sunlight and both earth and moon reflected sunlight as sources of LEM illumination. Geometric factor effects for the moon are treated by lunar surface mapping and use of lunar reflectivity model tables. The eclipsing of the sun and earth by the moon relative to LEM is considered. Author

N66-27064*# Grumman Aircraft Engineering Corp., Bethpage, N. Y.
PHOTOMETRIC MEASUREMENTS OF SIMULATED LUNAR SURFACES Final Report
J. D. Halajian and F. A. Spagnolo Apr. 1966 166 p refs
(Contract NAS9-3182)
(NASA-CR-65365; RE-245) CFSTI: HC $5.00/MF $1.00 CSCL 03B

This study was conducted to determine engineering properties of the optical lunar surface by means of physical and theoretical models that obey known photometric properties of that surface. The photometric analyzer was overhauled and recalibrated. Major instrumental modifications include added filters for spectrophotometric measurements, and an enlarged beam splitter to record brightness changes near zero phase angles with high fidelity. Albedo and brightness were measured as a function of wavelength on six specimens ranging from fine powders to massive slags. Most specimens exhibit the opposition effect which is tentatively attributed to color and roughness effects. Their albedo is wavelength dependent. Experimental and analytical studies are made of the photometry of dust clouds leading to negative results which indicate that dust clouds fail to exhibit the lunar backscattering characteristics. Computer analyses are performed to correlate the photometric and geometric properties of various idealized patterns consisting of horizontal and/or vertical elements. Shadowing, albedo, and scattering law effects on the photometric function are analyzed and evaluated. Vertical elements, horizontal overhanging members, and secondary pits are shown to be necessary building blocks for a model that simulates lunar light backscatter. R.N.A.

N66-27071*# Cambridge Univ. (England).
ON THE EFFECTS OF THE NON-CONSERVATION OF BARYONS IN COSMOLOGY
F. Hoyle and J. V. Narlikar [1965] 35 p refs Submitted for Publication Prepared jointly with Calif. Inst. of Tech.
(Grant NGR-05-002-028; Contract Nonr-220(47))
(NASA-CR-67874) CFSTI: HC $2.00/MF $0.50 CSCL 03C

The idea underlying this paper is that the massive objects, now known to be associated with radio sources and with quasi-stellar objects, are of cosmological significance; and that the energy output of these objects is associated with the problem of creation in cosmology. We have used the same equations describing creation of matter, as before; but have taken account of the fact that they contain far wider cosmological implications than have been explored hitherto. The present paper only deals with the more conventional aspects of the steady-state theory. Full exploration of the creation process leads to a radical departure from the old steady-state concept. For convenience of presentation, these less conventional ideas are described in a separate paper. Author

N66-27084*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DETERMINATION OF MEAN ELEMENTS FOR VINTI'S SATELLITE THEORY
N. L. Bonavito [1965] 13 p refs Submitted for Publication
(NASA-TM-X-56774) CFSTI: HC $1.00/MF $0.50 CSCL 03C

The method developed by Vinti for predicting the motion of an artificial satellite is used to obtain the first order partial derivatives in the conditional equations. These in turn are used in orbit improvement programs to determine the mean elements of Vinti's theory, corresponding to a separable Hamiltonian. The results have been programmed and tested on the IBM 7094 Mod. II. Author

N66-27085*# National Aeronautics and Space Administration, Washington, D. C.
PERTURBATIONS IN THE MOTION OF ARTIFICIAL SATELLITES DUE TO THE ELIPTICITY OF THE EARTH [VOZMUSHCHENIYA V DVIZHENII ISKUSSTVENNYKH SPUTNIKOV, VYZYVAEMYYE SZHATIEM ZEMLYA]
V. F. Proskurin and Yu. V. Batrakov Dec. 1963 21 p refs Transl. into ENGLISH from Byul. Inst. Teor. Astron. (Leningrad), v. 7, no. 7, 1960 p 537-548
(NASA-TT-F-8718) CFSTI: HC $1.00/MF $0.50 CSCL 22C

Literal expressions have been received for first order perturbations in the orbital elements of artificial satellites of the Earth accurate to the first power of the Earth's flattening and the fifth power of the orbital eccentricity through. The coefficients of these expressions depend on the inclination of the orbit by means of trigonometrical polynomials. More accurate expressions are given for secular first order perturbations in the longitude of the node, in the argument of the perigee and in the mean anomly. The secular motion of the node has been determined with account of second order perturbations due to the Earth's flattening. A numerical example illustrates the compartive value of the perturbations. Author

N66-27183*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER MARS 1964 FLIGHT DYNAMIC DATA
J. E. Randolph 15 May 1966 99 p refs
(Contract NAS7-100)
(NASA-CR-75339; JPL-TM-33-278) CFSTI: HC $3.00/MF $0.75 CSCL 22A

This memorandum analyzes the dynamic flight environment of the Mariner Mars 1964 spacecraft. The reduced data from Mariner III and Mariner IV are presented and compared. Nine environmental measurements were taken for each spacecraft. These consisted of five vibration transducers within the payload area of each launch vehicle and four microphones mounted outside the vehicle on the launch complex umbilical tower. These telemetered and recorded data have been analyzed using the following techniques: oscillograms, bandpass, power spectra, shock spectra, and data compression. The reduced data are discussed with reference to each appropriate analysis technique. No comparison with ground test data is made. Author

N66-27186*# National Aeronautics and Space Administration, Washington, D. C.

PHYSICS OF METEORS [PHYSIQUE DES METEORES]

J. Delcourt Feb. 1964 76 p refs Transl. into ENGLISH of Groupe de Rech. Ionospheriques Tech. Note 16, 22 Nov. 1963 (NASA-TT-F-8802) CFSTI: HC $3.00/MF $0.75 CSCL 03B

The present report reviews various papers on the physical theory of meteors, and attempts to synthesize them for applications to radio meteors. Author

N66-27191*# National Aeronautics and Space Administration, Washington, D. C.

IN QUEST OF SIGNS OF CIVILIZATION IN OTHER WORLDS [O POISKAKH SLEDOV TSIVILIZATSII V INYKH MIRAKH]

M. A. Voronin Mar. 1964 9 p refs Transl. into ENGLISH from Priroda (Moscow), no. 11, 1962 p 78–83 (NASA-TT-F-8590) CFSTI: HC $1.00/MF $0.50 CSCL 03C

The Russians presume that intelligent life exists on other planets, since it is impossible to imagine that in the entire universe it developed only on our earth. It is obvious that if intelligent beings of any planet have perfected interplanetary flights and are capable of realizing long distance radio communication, they have a high level of civilization. Since it can be assumed that the earth is not the only planet inhabited by intelligent beings, and since, in all probability, there are many planets in other solar systems that have comparable physical conditions, there must be sufficient civilization to have solved these problems. Therefore, it is highly improbable that the earth or some planets of the solar system were never visited by anyone in the past (perhaps a very distant past); or that there are no artificial radio waves in the interplanetary space produced by some type of device, including television, existing in worlds inhabited by intelligent beings. Therefore, it is necessary to seek more extensively the real signs of life, particularly, of intelligent life in our galaxy. I.v.L.

N66-27192*# National Aeronautics and Space Administration, Washington, D. C.

RADIO EMISSIONS AND THE NATURE OF THE MOON [RADIOIZLUCHENIYE I PRIRODA LUNY]

V. D. Krotikov and V. S. Troitskiy Mar. 1964 73 p refs Transl. into ENGLISH from Usp. Fiz. Nauk (Moscow), v. 81, no. 4, Dec. 1963 p 584–639 (NASA-TT-F-8837) CFSTI: HC $3.00/MF $0.75 CSCL 03B

This article discusses the investigation of the physical conditions of the moon by means of its radio emission. Taken into consideration are the lunar-surface temperature, the structure of the lunar crust, the thermal properties of the lunar crust, density and dielectric constants of rocks in the lunar crust, and the thermal radiation and thermal state of the lunar interior. C.L.W.

N66-27197*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

SATELLITE LIBRATION ON AN ELLIPTICAL ORBIT

Han-Shou Liu [1965] 23 p refs Submitted for Publication (NASA-TM-X-56173) CFSTI: HC $1.00/MF $0.50 CSCL 22C

The libration of a gravitationally oriented rigid satellite on an elliptic orbit is studied by the method of canonical transformation. The possibility of the center of mass of a satellite traveling on an elliptic orbit is examined. The transformations are performed in a mathematical way according to an operational method of perturbation conserving Hamiltonian formalism. The orbit eccentricity effect upon the amplitude and the frequency shift of the libration are exhibited. The ultimate nature of satellite libration on an elliptic orbit is revealed. Author

N66-27221*# Consultants and Designers, Inc., Arlington, Va.

FIRST RESULTS OF A RADIOASTRONOMICAL OBSERVATION OF AN ANNULAR SOLAR ECLIPSE [PERVYYE REZUL'TATY RADIONABLYUDENIY KOL'TSEOBRAZNOGO ZATMENIYA SOLNTSA]

A. P. Molchanov and K. N. Tavastsherna 15 Aug. 1963 6 p Transl. into ENGLISH from Vestn. Akad. Nauk SSR (Moscow), no. 3, Mar. 1963 p 98–100 (Contract NAS5-2078) (NASA-TT-F-8620; ST-RA-10035) CFSTI: HC $1.00/MF $0.50 CSCL 03A

Radiometric observations of the annular solar eclipse of 31 July 1962 by an astronomical expedition in Mali are presented and compared to data obtained during the 19 April 1958 and 15 February 1961 eclipses. The following preliminary conclusions are derived: (1) the emission spectrum in the 3.2- to 4.5-cm wavelength band of the 31 July 1962 eclipse was notably flatter than the spectra obtained earlier, indicating a lesser magnetic-field magnitude; (2) the bright limb in the solar disk at $\lambda=4.5$ cm was found to end in the region $0.939<r/R_{\odot}<0.972$, where $R_{\odot}$ is the radius of the solar photosphere; (3) the sun's ellipticity at $\lambda=3.2$ cm was clearly registered, and these data will be used to calculate the degree of solar corona influence upon the lower layers of its atmosphere. M.P.G.

N66-27238*# Geophysics Corp. of America, Bedford, Mass.

THE METEOROLOGY OF MARS AND VENUS Final Report

George Ohring, Edward M. Brooks, and Joseph Mariano Mar. 1964 116 p refs (Contract NASw-704) (NASA-CR-75315; GCA-TR-64-4-N) CFSTI: HC $4.00/MF $0.75 CSCL 03B

A thermodynamic diagram for the Martian atmosphere is constructed, based upon a model atmosphere, consisting of 83% nitrogen, 11% carbon dioxide, and 6% argon, with a surface pressure of 25 mb. A theoretical study of tides in the Martian atmosphere indicates that tidal motions play no significant role in Martian meteorology. An estimate of the annual radiation budget reveals that below latitude 35° there is a surplus of radiational energy, and above 35° there is a deficit. Improved greenhouse models for the Venus atmosphere are developed and discussed. A two-layer greenhouse model, consisting of a troposphere with arbitrary but constant lapse-rate of temperature, and an isothermal stratosphere in gross radiative equilibrium, is applied to Venus, Mars, and Earth. For Venus, the computations indicate that the observed high surface temperatures can be the result of a strong greenhouse effect due to an infrared-opaque cloud high in the Venus atmosphere and carbon dioxide or other infrared absorbers in the atmosphere. Estimates of solar radiation absorbed by carbon dioxide in the Venus atmosphere indicate that about 12% of the solar radiation is absorbed by carbon dioxide near infrared bands. Author

N66-27241*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

ASTRONAUTICS INFORMATION ABSTRACTS. REPORTS AND OPEN LITERATURE, VOLUME VII, NO. 6

V. S. Anderson, N. Ives, T. P. Mac Donald, B. H. Nichols, and E. C. Sidwell, comp. Jun. 1963 138 p refs
(Contract NAS7-100)
(NASA-CR-75252) CFSTI: HC $4.00/MF $1.00 CSCL 22A

A selective compilation of astronautics information abstracts is presented. The report and open literature citations are restricted to the subject of space flight and to applicable data and techniques. Author, subject, and source indexes are included as well as periodical citations. R.N.A.

N66-27244*# IIT Research Inst., Chicago, Ill. Technology Center.
STUDIES OF LUNAR SOIL MECHANICS Final Report, 15 Dec. 1965–1 Mar. 1966
E. Vey and John D. Nelson May 1966 163 p refs
(Contract NASr-65(02); ITTRI Proj. M272)
(NASA-CR-75323) CFSTI: HC $5.00/MF $1.00 CSCL 03B

An investigation was conducted on the effect of ultra-high vacuum on the properties of simulated lunar soils. The materials used consisted of fine grained powders of quartz, obsidian, enstatite and olivine. Fine grained enstatite sand was also used for a limited number of experiments. The results of direct shear tests and measurements of the resistance to dynamic penetration showed an increase in the soil strength under vacuum due to increases in both the stiffness and shear strength parameters. The magnitude of the increase, however, was dependent upon mineralogical composition because of variations in the amounts of initially adsorbed and/or absorbed gas. Static penetrometer experiments were also performed and the results correlated with the amount of gas desorbed from the soil prior to measuring the penetration resistance. The strength of the soil was observed to vary exponentially with the relative cleanliness and extrapolation of the results to atomically clean surfaces yielded values of penetration resistance substantially less than that of the same material sintered at high temperatures. Author

N66-27306*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RESEARCH ACHIEVEMENTS REVIEW SERIES NO. 20: MATHEMATICS AND COMPUTATION RESEARCH
1966 31 p refs
(NASA-TM-X-53420) CFSTI: HC $2.00/MF $0.50 CSCL 03C

CONTENTS:

1. RESEARCH IN COMPUTATIONAL MATHEMATICS AND LANGUAGES C. L. Bradshaw p 1–7 refs (See N66-27307 15-08)

2. NEW ONE-STEP INTEGRATION METHODS OF HIGH ACCURACY E. Fehlberg p 9–17 refs (See N66-27308 15-30)

3. RECENT DEVELOPMENTS IN ANALYTICAL CELESTIAL MECHANICS R. F. Arenstorf p 19–22 refs (See N66-27309 15-30)

N66-27308*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
NEW ONE-STEP INTEGRATION METHODS OF HIGH ACCURACY
Erwin Fehlberg *In its* Res. Achievements Rev. Ser. No. 20 1966 p 9–17 refs (See N66-27306 15-30) CFSTI: HC $2.00/MF $0.50

New numerical methods for the solution of periodic trajectories for the restricted three body problem are presented and factors affecting both the accuracy of results and the reduction of electronic computer time through the use of the new methods are discussed. Extension of the Runge–Kutta method to higher order of accuracy and the establishment of a pure series expansion method with transformation of the original differential equations to a second-degree algebraic system and application of recurrence formulas has provided a method to more effectively use computer capability and point the way for use of the new methods in many space problems. Author

N66-27309*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RECENT DEVELOPMENTS IN ANALYTICAL CELESTIAL MECHANICS
Richard F. Arenstorf *In its* Res. Achievements Rev. Ser. No. 20 1966 p 19–22 refs (See N66-27306 15-30) CFSTI: HC $2.00/MF $0.50

For the restricted problem of three bodies the derivation of periodic solutions different from the classically known ones is discussed and the ideas used for their existence proofs are briefly outlined and related to classical methods. In particular, the derivation of closed perturbed precessing elliptic orbits of arbitrary eccentricity and small major axis about the smaller one of the two attracting bodies with arbitrary mass ratio is indicated. Two numerical examples of recently discovered closed trajectories are included. Author

N66-27531*# Exotech, Inc., Alexandria, Va.
ANALYSIS OF PLANETARY QUARANTINE REQUIREMENTS
Samuel Schalkowsky and William C. Cooley 5 Apr. 1966 16 p
(Contract NASw-1340)
(NASA-CR-75408) CFSTI: HC $1.00/MF $0.50 CSCL 22A

A simple but adequate analytical framework is provided to define the relationship between planetary quarantine requirements and estimated probabilities of planet contamination. Emphasis is placed on the form in which the requirements are to be stated so as not to constrain their implementation unnecessarily. Specific numerical values for the requirements are given, based on an assumed set of values for the "judgment factors" which enter into the analytical model. Alternate sets of requirements are compared and discussed. A detailed definition of nomenclature is provided to encourage standardization of future analysis in this area. Author

N66-27534*# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.
GEOMETRY OF BACKSCATTERING SURFACES AS APPLIED TO THE MOON
J. D. Halajian Dec. 1965 49 p refs Presented at the 4th Ann. Meeting of the Working Group on Extraterrest. Resources, Colorado Springs, 29 Nov.–2 Dec. 1965
(Contract NAS9-3182)
(NASA-CR-75426; RE-219J(Phase II)) CFSTI: HC $2.00/MF $0.50 CSCL 03B

The relationship between the photometric and geometric properties of the lunar surface is studied by means of artificial models that lend themselves readily to controlled manipulation and analysis. Composite models consisting of dust covered geometric solids permit the study of the relative contribution of micro and macroroughnesses on the total backscatter. A simple, i.e., dust-free, model built by means of thumb tacks helps to demonstrate that shadowing on and within a dark, porous structure can primarily be responsible for the backscattering exhibited by the lunar surface and that both quasi-horizontal and quasi-vertical members having a well-defined

proportion and spacing appear to be necessary components of a lunar photometric model. Simple models of the thumb tacks variety help the experimenter to interpret the lunar data or their terrestrial analogs in terms of relevant properties. These models appear also to be convenient tools for the simulation and study of some recently observed lunar photometric phenomena as well as for the study of other reflecting celestial bodies of known photometry. Author

N66-27535*# Brown Engineering Co., Inc., Huntsville, Ala. Research Labs.

A MISSION FOR SURVEYING AND MAPPING THE LUNAR SURFACE

S. N. Heaps Apr. 1966 87 p refs

(Contract NAS8-20166)

(NASA-CR-75417; R-192) CFSTI: HC $3.00/MF $0.75 CSCL 22A

A three-man lunar mission has been planned in which eleven remote sensing instruments are operated for eight days in a polar orbit. From the elevation of 81.5 km (44 n mi), the high resolution stereoscopic photographs and celestial navigation sightings provide accurate location data for the Earth-science observations. The mission is one of a series proposed under the Apollo Applications Program. Author

N66-27541*# California Inst. of Tech., Pasadena.

[INVESTIGATION OF THE PROBLEMS OF LUNAR AND PLANETARY EXPLORATION] Annual Report, 1 Dec. 1964–30 Nov. 1965

Harrison Brown and Bruce C. Murray 25 Apr. 1966 21 p refs

(Grant NsG-56-60)

(NASA-CR-75342) CFSTI: HC $1.00/MF $0.50 CSCL 03B

This report summarizes research activities during this period on a study of lunar and planetary exploration problems. This research was conducted in three principle areas: (1) characteristics of planets, meteorites, and asteroids, particularly regarding orbital distribution and chemistry, which may afford clues as to the origin and evolution of those objects as well as to the solar system, (2) ground based physical observations of the moon and planets, and related interpretations, in the visible and long wavelength infrared, and (3) laboratory investigations of the thermal radiative properties of powders in vacuum, with applications to the interpretation of lunar infrared observations. The graduate student program connected with this research is outlined and its relation to the space program is discussed. R.N.A.

N66-27563# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

LATEST ACHIEVEMENTS OF SOVIET SCIENCE IN THE CONQUEST OF SPACE

Zbigniew Jethon 21 Jan. 1966 20 p Transl. into ENGLISH from Wojskowy Przeglad Lotniczy (Warsaw), v. 19, no. 8, 1965 p 48–59

(FTD-TT-65-1704/1+2+3+4; AD-630879) CFSTI: HC $1.00/MF $0.50

This paper discusses some of the latest Soviet achievements in their space program. These include manned space flight studies on the effects of acceleration, vibration, weightlessness, and cosmic radiation; muscular coordination; hypersensitivity of the vestibular organ; alimentation; isolation; physiological and psychological stress; telemetry systems; and extravehicular activity. R.N.A.

N66-27582# Texas Technological Coll., Lubbock. Dept. of Chemistry.

SPECTRAL STUDIES OF MATERIALS POSSIBLY PRESENT ON THE MARTIAN SURFACE Final Report, 1 Feb. 1965–31 Jan. 1966

Arthur L. Draper and Joe A. Adamcik 1 Apr. 1966 11 p refs

(Contract Nonr(G)-00035-65)

(FR-1, AD-630806) CFSTI: HC $1.60/MF $0.50

Comparisons of the reflectance spectra of synthetic mixtures have been made with the observed spectrum of Mars in an effort to develop a mixture congruous with the Martian soil. Mixtures containing various amounts of the iron oxides geothite and hematite as the coloring material show the features of the Martian spectrum, particularly when the gothite and hematite are precipitated on finely ground quartz and kaolin. However, such mixtures are much more reflective than the planet. To date, two promising mixtures have been made, one prepared by the addition of the dark material magnetite, blende. The spectra of these two mixtures closely match the spectrum of Mars in the visible region and bracket it in the infrared. Author (TAB)

N66-27637# Air Force Systems Command, Wright-Patterson AFB, Ohio. Flight Dynamics Lab.

A CLOSED-FORM SOLUTION TO LIFTING REENTRY Technical Report, Aug. 1964–Mar. 1965

Roland N. Ball Jan. 1966 72 p refs

(AFFDL-TR-65-65; AD-631590) CFSTI: HC $8.60/MF $0.75

This report derives closed-form expressions for predicting the longitudinal and lateral range attainable by lifting reentry vehicles. The resultant equations sensitively and accurately define the influence of L/D ratio, bank angle and entry velocity variations over a spectrum of values. To illustrate the usefulness of the method, the derived expressions were used to conduct a parametric reentry study covering a range of L/D ratios from 0.5 to 4.0, bank angles from 0 to 75 degrees and entry velocities from $0.89V_c$ to $0.99V_c$. The results of this study are compared with those obtained from a high speed computer study using the same range of reentry conditions. As an aid to future investigators, a series of curves is presented giving longitudinal and lateral range values for various selected L/D, bank angle and entry velocity values. For those wishing to investigate reentry under conditions not covered by these curves, a detailed 'recipe' for utilizing the method is included in an appendix. A comparison of the results of this method with those of more rigorous methods for the same reentry conditions shows that the closed-form solution has sufficient accuracy and sensitivity to be of considerable value to those persons requiring a rapid, preliminary estimate of vehicle performance. Author (TAB)

N66-27646# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

HERALD OF THE ACADEMY OF SCIENCES OF THE USSR Selected Articles

29 Jun. 1965 9 p Transl. into ENGLISH from Vestn. Akad. Nauk SSR (Moscow), v. 34, no. 5, 1964 p 126–127, 134–135

(FTD-TT-65-311/1+4; AD-621000) CFSTI: HC $1.00/MF $0.50

CONTENTS:

1. CONFERENCE OF REPRESENTATIVES OF SOCIALISTIC COUNTRIES ON PROBLEMS OF OBSERVING MAN-MADE EARTH SATELLITES N. P. Slovokhotov p 1-3

2. AT THE ASTRONOMICAL COUNCIL (SESSION OF THE SOVIET AND ITS COMMISSIONS) N. P. Yerpylev p 4-5

N66-27726*# Ohio State Univ. Research Foundation, Columbus.
SPACE JOBS
Herman J. Peters, James J. Ves'sells, and Samuel F. Angus 1966 17 p refs Prepared for NASA
(NASA-EP-31) GPO: HC $0.15; CFSTI: MF $0.50 CSCL 22A

A booklet which is intended to stimulate and direct young students to careers in the space industry is presented. Vocational guidance is provided by giving descriptions of space workers, jobs in space, space travelers, and spaceships. C.T.C.

N66-27727*# Ohio State Univ. Research Foundation, Columbus.
LEARNING ABOUT SPACE CAREERS
Herman J. Peters, Samuel F. Angus, and James J. Ves'sells 1966 28 p refs Prepared for NASA
(NASA-EP-32) CPO: HC $0.25; CFSTI: MF $0.50 CSCL 22A

A guidebook which is intended to produce ideas and vocational guidance to young students is presented. Information is given about the space industry and the world of work, and an overview is presented of the career choices related to opportunities in space science, engineering, and technology. C.T.C.

N66-27728*# Ohio State Univ. Research Foundation, Columbus.
SEVEN STEPS TO A CAREER IN SPACE SCIENCE AND TECHNOLOGY
Herman J. Peters, Samuel F. Angus, and James J. Ves'sells 1966 64 p refs Prepared for NASA
(NASA-EP-33) GPO: HC $0.45; CFSTI: MF $0.50 CSCL 22A

This guidebook brings together ideas and suggestions for things to do to help with career choice, and includes information about the space industry and the world of work. Vocational guidance is given for the space age, and an overview of career choice related to the opportunities in space science, engineering, and technology is included. C.T.C.

N66-27737*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AS-202 LAUNCH VEHICLE OPERATIONAL FLIGHT TRAJECTORY
Pamelia B. Pack 3 Jun. 1966 140 p refs
(NASA-TM-X-53470) CFSTI: HC $4.00/MF $1.00 CSCL 22C

This report presents the launch vehicle operational flight trajectory for the Saturn IB vehicle AS-202. Included is a discussion of the predicted trajectory, the mission objectives, and constraints, plus the associated dispersion study, and tracking summary. A successful flight will place an Apollo spacecraft into a lob-type trajectory and will aid in determining the performance of the launch vehicle and spacecraft subsystems in preparation of manned orbital missions. Author

N66-27765*# Georgetown Univ., Washington, D. C. Coll. Observatory.
SPECTROSCOPIC STUDY OF SOLAR AND PLANETARY ATMOSPHERES Semiannual Status Report No. 6, Aug. 1, 1965-Feb. 1, 1966
Francis J. Heyden [1966] 16 p
(Grant NsG-362)
(NASA-CR-75488) CFSTI: HC $1.00/MF $0.50 CSCL 03B

This report describes activities performed during this period on spectroscopic studies of solar and planetary atmospheres. Spectral observations made on Venus and Jupiter are discussed. An attempt is being made to prove the existence of nitrogen oxides in the Martian atmosphere by identifying spectral lines or bands in the planet's spectrum. The main problems in positively identifying these lines and procedures to circumvent these difficulties are outlined. Infrared spectral reflectance measurements made of the Martian atmosphere are described and the results discussed. R.N.A.

N66-27937*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VENUS: PRELIMINARY SCIENCE OBJECTIVES AND EXPERIMENTS FOR USE IN ADVANCED MISSION STUDIES
Roy G. Brereton 22 Dec. 1965 57 p
(NASA-CR-75609; EPD-328) CFSTI: HC $3.00/MF $0.50 CSCL 03B

Scientific objectives and supporting experiments are described for proposed Marine-type spacecraft missions to the planet Venus in the 1970's. Consideration is given to flyby and capsule missions, and a combination of the two is thought to offer the most potential in terms of providing the necessary scientific information. Atmosphere, composition, biology, and field and particles of Venus are discussed; and the various types of experiments required are described. M.W.R.

N66-27957# State Univ. of Iowa, Iowa City. Dept. of Physics and Astronomy.
A MARINER/VENUS 1967 EXPERIMENT ON SOLAR X-RAY ECLIPSE BY THE VENUSIAN ATMOSPHERE
J. A. Van Allen 23 Feb. 1966 22 p refs *Its* Rept.-66-4
CFSTI: HC $1.00/MF $0.50

A physical modification to the Mariner/Venus MC-4 space probe experimental package is proposed and described. The modification consists of remounting one of the mica-window Geiger tubes (detector A) so that it is pointed continuously at the sun. The change would make possible the continuous monitoring of soft X-rays (0-14Å) from the sun throughout the flight, including the measurement of the eclipse of solar X-rays by the Venusian atmosphere. An exemplary calculation is presented, showing that assuming a time resolution of 1 second in the data from detector A, it is possible: (1) to determine the absolute atmospheric density ρ to an accuracy of about 20% in the vicinity of $\rho = 2 \times 10^{-9}$ g/cm^3 and (2) to determine the mean scale height of the atmosphere to an accuracy better than 10% over the density range 2×10^{-8} g/cm^3. Several pertinent factors regarding the time resolution, accuracy, and the scheme of the experiment are discussed, and schematic diagrams depicting the geometry of the spacecraft trajectory, and experimental angle are also presented. A plot of calculated absorption curves is also given. L.S.

N66-27983# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Grumman Research Dept.
SOME REMARKS CONCERNING THE NEWTON-RAPHSON ALGORITHM AND ABNORMALITY IN ATMOSPHERIC ENTRY CONTROL PROBLEMS
M. Falco and F. Sobieralski Mar. 1966 41 p refs
(RE-244)

A connection is made between the appearance of abnormal trajectories in optimal control problems and convergence difficulties of the Newton-Raphson iterative technique in producing numerical solutions to the nonlinear two-point boundary value problem in these cases. The connection is displayed in the context of a particular time-fixed optimal control problem involving an atmospheric entry vehicle for which numerical evidence has been obtained. Author

N66-28011*# Cutler-Hammer, Inc., Deer Park, N. Y.
INVESTIGATION OF NEW IONOSOUNDER TECHNIQUES
Washington, NASA, Jun. 1966 182 p refs
(Contract NAS5-9106)
(NASA-CR-493) CFSTI: HC $5.00/MF $1.25 CSCL 03B

The objective of this report was to study the feasibility of experiments using radio sounding techniques for the investigation of the ionospheric properties of Mars and Venus. The study effort was divided into two areas. Constraints were applied in size, weight, and power consistent with modern spacecraft technology. The techniques study was concerned with instrumentation suitable for sounding a planetary ionosphere from nearby to 100,000 km from the planet in flyby or orbiting spacecraft. A parametric analysis related power, resolution, frequency, range, and other parameters of importance. A system analysis was performed using the methods of modern radar systems and applying them to ionospheric sounding. The results were applied to a specific mission, such as a Voyager flight to Mars, with requirements to sound from distances of 1000 to 40,000 km. A system to accomplish such a mission is described. Author

N66-28021*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EARTH ORBITAL LIFETIME PREDICTION MODEL AND PROGRAM
Ann R. Mc Nair and Edward P. Boykin 1 Feb. 1966 202 p refs
(NASA-TM-X-53385) CFSTI: HC $6.00/MF $1.25 CSCL 22A

An earth orbital satellite lifetime deck has been developed and programmed in Fortran IV language for the IBM 7094. The deck represents the development of a sophisticated and accurate lifetime prediction technique, which includes the effect of aerodynamic drag and the nonspherical gravitational potential of the earth. The computer program can be used to predict lifetime based on only a gross description of the initial orbit and drag parameters, or based on a very exact definition of the initial orbit and detailed description of the drag parameters and their variations depending on the amount of information available. The primary factor contributing to uncertainty in lifetime predictions using this model is the atmospheric density. A very flexible model based on data from Discoverer, Gemini, and Saturn flights has been established. The primary uncertainty remaining in this model is prediction for future years of solar activity behavior and its influence on density as a function of altitude. As additional flight data and solar activity observations become available, they may readily be incorporated into the model, thus providing a rapidly changing density model which insures the best representation possible. Efforts to refine the models as presently defined and to perform pertinent studies in the lifetime area are continuing. This report represents only the present status of model definitions and defines the computer program now in use. Author

N66-28022*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ORBITAL CALCULATIONS AND TRAPPED RADIATION MAPPING
M. O. Burrell and J. J. Wright 8 Mar. 1966 34 p refs
(NASA-TM-X-53406) CFSTI: HC $2.00/MF $0.50 CSCL 22C

The Burrell Orbital Flux and Energy Spectra Code calculates the position of an earth satellite in geocentric and B-L coordinates. Utilizing the B-L coordinates, the code calculates the radiation flux and energy spectra for protons or electrons at any point in a circular or elliptical orbit. Author

N66-28027*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ANALYSIS OF AN INTERPLANETARY TRAJECTORY TARGETING TECHNIQUE WITH APPLICATION TO A 1976 VENUS FLYBY MISSION
Bobby Ellison 12 Apr. 1966 51 p refs
(NASA-TM-X-53434) CFSTI: HC $3.00/MF $0.50 CSCL 22C

A trajectory technique is discussed that, when systematically applied, enables the trajectory analyst to obtain a continuous, free-flight integrated trajectory from planet A to a desired target planet C via some intermediate target planet B. Basically, the scheme defines targeting parameters at the intermediate planet B in terms of the desired values at planet C. This allows an actual search between planets A and B, while, in reality, a targeting at planet C is taking place. An application of this targeting technique to a Venus flyby trajectory, i.e., A = Earth, B = Venus, C = Earth, is described in this report. Author

N66-28046# Cerro Tololo Inter-American Observatory, La Serena (Chile).
TABLES FOR USE AT THE CERRO TOLOLO INTER-AMERICAN OBSERVATORY
D. L. Crawford and A. U. Landolt Sep. 1965 41 p ref Sponsored by NSF *Its* Contrib. No. 7
CFSTI: HC $2.00/MF $0.50

This report presents three tables that may be useful to investigators using the telescopes at Cerro Tololo Inter-American Observatory. Table I gives the air mass for every 10^m of hour angle and for every degree of declination up to a limit of X = 5.0, or for an hour angle of 12^h, or a northern declination of +45°. Table II is a magnitude-deflection table useful for photometric reductions. Table III gives the diurnal radial velocity correction in km/sec for Cerro Tololo. R.N.A.

N66-28054# Smithsonian Astrophysical Observatory, Cambridge, Mass.
A SUGGESTION AS TO THE ORIGIN OF CHONDRULES
Fred L. Whipple 28 Mar. 1966 16 p refs
(SAO Special Rept.-206)

This discussion suggests that the millimeter sized glassy spheroids called chrondules that occur abundantly in stony meteorites may have been produced by lightning in the primitive Laplacian-type nebula as earthy materials were condensing and collecting to form the asteroids and the terrestrial planets. R.N.A.

N66-28162# Ministero della Difesa Aeronautica, (Italy).
PERTURBATIONS OF ARTIFICIAL SATELLITE ORBITS [LE PERTURBAZIONI DELL'ORBITA DEI SATELLITI ARTIFICIALI]

Severino Giorgi 1965 65 p refs In ITALIAN; ENGLISH summary *Its* Monografie Sci. e Tech. di Aeron. No. 25
CFSTI: HC $3.00/MF $0.75

The main perturbations to the motion of artificial earth satellites were studied using the orbital parameters variation method. Based on a consideration of the characteristics of each possible perturbation, a sixth order differential system whose unknowns are the six orbital parameters was derived. Several possibilities were examined for an elaboration of the system in connection with different space zones. D.T.

N66-28217# Defence Research Board, Ottawa (Ontario). Directorate of Scientific Information Services.
RELATIVE DEPTHS OF LUNAR RING MOUNTAINS AND CRATERS IN THE MARE NUBIUM
A. V. Markov May 1966 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 167, no. 1, 1966 p 63–64
(T-457-R) CFSTI: HC $1.00/MF $0.50

Values for the logarithms of the diameters, D, and depths, d, of lunar craters and ring mountains (walled plains) in the zone of the Mare Nubium (around the impact point of the Ranger VII spaceship) for craters ranging from 8.0 m to 67,2000 m in diameter were compared for testing the correctness of a formula put forth by Baldwin for craters in which diameters range from 2.0 km to 200 km. The data indicate that Baldwin's formula does quite closely represent the relationship between diameter and depth for the lunar craters measured by the spacecraft photographs. Departures from the formula were observed though for the very large ring plains and for some other craters which the possibility exists that after their formation the bottom was inundated, from inside, by lava. L.S.

N66-28237# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
ROLE OF NEGATIVE IONS IN LATE-TYPE STARS
M. S. Vardya 12 May 1966 65 p refs Submitted for Publication
(JILA-71) CFSTI: HC $3.00/MF $0.75

The role of twelve negative ions; six atomic, four diatomic, and two triatomic; has been investigated. It is found that besides H^-, Cl^-, C^- OH^-, C_2^-, CN^-, SH^- and H_2O^- may play significant roles in the outer layers of late-type stars. A better appraisal of the role of negative ions in astrophysics will, however, have to await further laboratory measurements and improved high dispersion stellar spectrophotometry, along with improved theoretical atmospheric models and elemental abundances. Author

N66-28250# RAND Corp., Santa Monica, Calif.
ON THE ROLE OF THE MESOPAUSE IN INTERACTION STUDIES
G. F. Schilling Apr. 1966 25 p refs
(P-3346; AD-631587) CFSTI: HC $2.00/MF $0.50

An earlier study emphasized that the understanding of interactions between thermosphere and mesosphere depends on quantitative knowledge of the physical processes taking place in the boundary layer, i.e., the mesopause. The present study demonstrates that the spatial and temporal behavior of mesosphere and lower thermosphere can indeed be depicted in a coherent way, consistent with empirical data, but only if these atmospheric regions are considered as separate entities. Attempts to derive quantitatively plausible connections between these two regions failed until it was assumed that the mesopause itself was not only a schematic boundary, but a region that exerts a dominant effect on the atmosphere above and below. Author (TAB)

N66-28260# Aeronautical Chart and Information Center, St. Louis, Mo.
COORDINATES OF LUNAR FEATURES, GROUP I AND II SOLUTIONS
Donald L. Meyer and Byron W. Ruffin Mar. 1966 101 p refs
(ACIC-TP-15; AD-631404) CFSTI: HC $4.00/MF $0.75

A series of one to one million scale charts of the moon and charts of potential landing sites are produced at the scale of one to five hundred thousand. Inadequacies of existing lunar control have necessitated the establishment of a new control program for measuring and reducing positions using earth based telescope photography. It is the purpose of this report to present the measurement and reduction methods employed and the lunar coordinates derived from the first two photo groups of a planned four photo group solution.
Author (TAB)

N66-28285# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE QUESTION OF EQUALIZATION OF OUTERSPACE TRIANGULATION
A. A. Kryzhanovskiy 23 Mar. 1966 7 p refs Transl. into ENGLISH from Geodez. i Kartograf. (Warsaw), no. 1, 1965 p 24–25
(FTD-TT-65-1732/1+2+4; AD-631444) CFSTI: HC $1.10/MF $0.50

An approximation method for solving the system of normal equations which appear in the equalization of observations of artificial earth satellite positions is discussed. The solution consists of seeking the approximation values of unknowns from a separate solution of the partial systems. The unknowns of the first approximation are used for computing the transformed free terms with the aid of conjunctive coefficients, and a secondary solution of a partial systems is derived. The approximations are continued until the necessary precision of the unknowns is obtained. N.E.N.

N66-28332# Defence Research Board, Ottawa (Ontario). Directorate of Scientific Information Services.
EXPLORATION OF THE TERRESTRIAL MAGNETOSPHERE IN THE REGION OF THE RADIATION BELT (3–6 R_e). FEBRUARY TO APRIL 1964. EXPLORATION BY ELEKTRON SATELLITES OF TERRESTRIAL MAGNETOSPHERE AT DISTANCE 7–11.7 EARTH RADII
Sh. Sh. Dolginov, Ye. G. Yeroshenko, and L. N. Zhuzgov May 1966 37 p refs Transl. into ENGLISH from the book "Space Res., Trans. of the All Union Conf. on Space Phys." Moscow, "Nauka" Press, 1965 p 342–367
(T-455-R) CFSTI: HC $2.00/MF $0.50

This paper examines the Elektron 2 satellite measurements of the magnetosphere made at distances of 3 to 6 R_e (earth radii) in the region of the outer radiation belt. The satellite orbit, the meteorological characteristics of the apparatus, the character of the magnetometric data, ΔT differences at distances of 3 to 6 R_e, the magnetic field of the trapped radiation, and the experimental results are discussed. The measurements testify to the existence of a quiet day external magnetic field due to protons and electrons of the radiation belts. Also included are the results of magnetic measurements by Elektron satellites in the outer terrestrial magnetosphere at distances of 7 to 11.7 R_e in the interval from 35°S to 60°S. The satellite orbit, the magnetosphere

region explored, the character of the magnetometric information, field variability on magnetically quiet and disturbed days, the fine structure of the effects of polar magnetic disturbances, and the transit of the magnetosphere boundary are discussed along with conclusions based on a comparison of satellite magnetograms with ground data. R.N.A.

N66-28333# Royal Aircraft Establishment, Farnborough (England).
EXOSPHERIC DENSITIES NEAR SOLAR MINIMUM DERIVED FROM THE ORBIT OF ECHO 2
G. E. Cook and Diana W. Scott Mar. 1966 32 p refs
(RAE-TR-66105) CFSTI: HC $2.00/MF $0.50

The density of the upper atmosphere at heights between 1080 and 1170 km is evaluated from the change in the orbital period of Echo 2 for dates between February 1964 and December 1965. The air density shows a pronounced semiannual variation, while the variation between day and night is unlikely to exceed a factor of 2. Author

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N66-27034*# National Aeronautics and Space Administration, Washington, D. C.
CONSTRUCTION AND LAUNCHING OF SCT-1 AND SCT-2 ROCKETS [LA CONSTRUCCION Y EL LANZAMIENTO DE LOS COHETES SCT-1 Y SCT 2]
Porfirio Becerril Buitron May 1963 16 p Transl. into ENGLISH from Comunicaciones y Transportes (Mexico), v. 2, no. 9, Nov.–Dec. 1960 p 38–48
(NASA-TT-F-8430) CFSTI: HC $1.00/MF $0.50 CSCL 22D

The SCT-1 and the SCT-2 are single-stage liquid-propellant rockets which were constructed and launched in Mexico. The SCT-1 had the following characteristics: deadweight of the rocket was 102.7 kg; weight of alcohol, liquid oxygen, and compressed air was 113.3 kg; outside diameter of the rocket was 0.375 m; total height was 4.48 m; and total width of wings was 1.184 m. On October 24, 1959, the rocket was successfully launched. Combustion was complete. The SCT-2 rocket had the following characteristics: deadweight of the rocket was 103.00 kg; weight of alcohol, liquid oxygen, and helium was 115.60 kg; weight of alcohol for refrigeration was 1.400 kg; outside diameter of the rocket was 0.375 m; total height was 4.480 m; and total width of wings was 1.184 m. The rocket was successfully launched on October 1, 1960. An altitude of 25,000 m was achieved. The effective ground-to-ground flying time was 180 seconds. I.v.L.

N66-27052*# AiResearch Mfg. Co., Los Angeles, Calif.
DEVELOPMENT OF SUBCRITICAL NITROGEN STORAGE AND DELIVERY SYSTEM FOR ORBITAL FLIGHT TESTING Final Report
25 Apr. 1966 97 p refs Its Rept.-66-0357
(Contract NAS9-4242)
(NASA-CR-65373) CFSTI: HC $3.00/MF $0.75 CSCL 22B

This report summarizes the work performed on a program to design, develop, test, and deliver subcritical nitrogen storage and delivery systems, including full instrumentation and telemetry signal conditioning equipment. One of the systems delivered was subjected to environmental testing to verify the flight capability of the design. The other system was identical to the first and is intended for orbital flight testing aboard a Saturn launch vehicle. This report presents a comprehensive description of the program, the equipment designs and hardware provided, the test results, and conclusions and recommendations. R.N.A.

N66-27068*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
NASA LANGLEY SMALL METEOROLOGICAL SOUNDING ROCKET DEVELOPMENT PROGRAM
Harold B. Tolefson [1965] 41 p Presented at the Indian Natl. Comm. for Space Res. Seminar on Sounding Rocket Tech. and Expt., Thumba, India, 11 Jan. 1965
(NASA-TM-X-56775) CFSTI: HC $2.00/MF $0.50 CSCL 22D

A program has been initiated to develop a small meteorological rocket system for atmospheric measurements in the altitude range from 30 km upwards to 70 km and possibly to 100 km. The objective is to provide a relatively inexpensive system for measuring the basic meteorological parameters of wind, temperature, density, and pressure with an overall reliability of 90 percent. Little or no restriction as to launch location or weather conditions and with direct short-time data availability are included. The paper discusses the work in progress and the achievements made to date. Future plans and the anticipated system progression are outlined. Author

N66-27073*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
THE OBJECTIVES AND DESIGN OF THE INERTIAL REFERENCE UNIT FOR THE LUNAR ORBITER
Jack M. Simon (Sperry Gyroscope Co., Great Neck, N. Y.) and Royce H. Sproull [1965] 13 p refs Presented at the 1965 Intern. Space Electron. Symp., Miami Beach, Fla., 2–5 Nov. 1965 Prepared jointly with Sperry Gyroscope Co., Great Neck, N. Y.
(NASA-TM-X-56776) CFSTI: HC $1.00/MF $0.50 CSCL 22B

The lunar orbiter, a photographic satellite, is one of the family of lunar reconnaissance spacecraft planned for the unmanned exploration of the moon prior to Project Apollo. The spacecraft requires a guidance capability for trajectory changes, for examples, midcourse corrections and transfer into lunar orbit, and for camera pointing during photography. The inertial sensing function for guidance is provided by the inertial reference unit. Author

N66-27217*# National Aeronautics and Space Administration, Washington, D. C.
JAPANESE ROCKET OBSERVATIONS AND EQUIPMENT
Tamiya Nomura Feb. 1964 22 p refs Transl. into ENGLISH from Soc. Instr. Control Engr. (Tokyo), v. 2, no. 6, 1963 p 395–405
(NASA-TT-F-8550) CFSTI: HC $1.00/MF $0.50 CSCL 22B

The following are discussed: (1) Japanese rocket observation systems—observation rockets and telemetry and radar equipment; (2) in-flight test equipment; and (3) observations and methods—atmospheric structure, ionosphere, cosmic rays, airglow, terrestrial magnetism (attitude-sensing devices), solar flares, and radio phenomena. P.V.E.

N66-27240*# State Univ. of Iowa, Iowa City. Dept. of Physics and Astronomy.
THE RESPONSES OF THE UNIVERSITY OF IOWA CHARGED PARTICLE DETECTORS ON EXPLORER 12 Graphic Summary
L. A. Frank, R. C. Bohlin, and R. J. DeCoster Apr. 1966 227 p refs *Its* Rept.-66-15
(Grant NsG-233-62)
(NASA-CR-75227) CFSTI: HC $6.00/MF $1.25 CSCL 22B

Graphs of the responses of charged particle detectors on Explorer 12 are displayed for the period extending from launch on 16 August 1961 to 6 December 1961 when transmission of data terminated. This graphic summary provides a convenient abridged dictionary of available data and a convenient guide for further processing of the data. Author

N66-27277# Space-General Corp., El Monte, Calif.
DEVELOPMENT OF MANUFACTURING TECHNIQUES FOR A METAL FABRIC REINFORCED RE-ENTRY PARAGLIDER
J. F. Keville *In* AFSC, Wright-Patterson AFB, Ohio Aerospace Expandable Struct. [1966] p 235–247 (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

Work was performed on the development of manufacturing techniques, components, and materials for an inflatable, metal fabric reinforced reentry vehicle. The paraglider itself is an inflated body made up of three tapered booms connected to a common toroidal apex. Attached between the center boom and each leading edge boom is a thin flexible wing membrane which assumes an approximately semiconical shape during flight. The booms taper from 32 inches in diameter at the forward end to 13 inches at the aft end; length overall is 23 feet. Jets at boom tips are used for attitude control while aft edge of wings can be gathered and pulled downward or let out for aerodynamic flight control. The materials selected were a nickel–chromium metal fabric woven from fine filaments, and two kinds of silicone rubber—one for impregnating the two plies of metal fabric, and the other for exterior coating as an ablative and heat resistant material. D.T.

N66-27283# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FABRICATION AND PRESSURIZATIONS TECHNOLOGY FOR IMPROVEMENT OF SURFACE ACCURACY OF PASSIVE COMMUNICATIONS SATELLITES
David C. Grana and Walter E. Bressette *In* AFSC, Wright-Patterson AFB, Ohio Aerospace Expandable Struct. [1966] p 603–616 ref (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

The errors inherent in the fabrication technique, improved manufacturing procedures, and the effect of the number of gores are reviewed. The strain in the satellite material is described theoretically, and an expression is developed for the strain in terms of the number of the gores. A formula is also presented for the inherent error in terms of width and number of gores. Experimental details are given for the photogrammetric measurements of 12 ft spheres with 32, 48, and 64 gores at low and high pressures, and the results are plotted. Among the conclusions are: the permanent strain required to strain an approximate sphere to spherical shape is dependent only upon the number of gores and decreases with an increased number of gores; stress–strain data obtained by a biaxial diaphragm technique agreed with the easier to obtain Instron data; and the strain required to remove the maximum expected fabrication errors varied from pole to equator by as much as a factor of 10 with the pole area requiring the greatest correction. N.E.N.

N66-27296# Fairchild Hiller Corp., Rockville, Md. Space Systems Div.
DEPLOYMENT SYSTEM FOR THE PEGASUS METEOROID TECHNOLOGY SATELLITE
Eugene R. Ganssle *In* AFSC, Wright-Patterson AFB, Ohio Aerospace Expandable Struct. [1966] p 649–757 (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

The deployment system of the Pegasus satellite is reviewed. The configuration requirements are listed, and details are given on the wing section, the center section, and the solar panels. The sequence of the orbital deployment is outlined. Dynamic testing of a full scale model and the testing apparatus are described. The particular problems for performing deployment on a 96-foot span structure which could not sustain one g loads are discussed. It was considered that the deployment test series proved its value in establishing basic criteria and techniques for testing on prototype and flight spacecraft. N.E.N.

N66-27297# North American Aviation, Inc., Downey, Calif. Space and Information Systems Div.
STRUCTURAL BEHAVIOR OF TAPERED INFLATED FABRIC CYLINDERS UNDER VARIOUS LOADING CONDITIONS
L. Kovalevsky and F. L. Rish *In* AFSC, Wright-Patterson AFB, Ohio Aerospace Expandable Struct. [1966] p 659–685 refs (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

Approximate relations for the design of inflatable members of linearly variable cross sections under various loadings are discussed. The circular cylindrical model with fibers oriented at an angle to the circumferential and longitudinal directions was investigated. Equations are developed for shear and tensile stress. It was found that the total tension could be assumed to be carried by the fibers only, and the shear stress taken exclusively by the elastomer. Equations for the angle of rotation of the cylinder for the effective modulus of elasticity in the longitudinal direction are developed. The difficulties involved with fiber orientation in a conical section are indicated. Skin stresses of the inflated cone are investigated, with respect to internal pressure, axial compression, and torsion, along with the effect of variable modulus of elasticity and Euler buckling load. The analysis includes the degree of approximation and also the procedural limitations. N.E.N.

N66-27299# Goodyear Aerospace Corp., Akron, Ohio.
RECENT APPLICATIONS OF INFLATED STRUCTURES TO AEROSPACE VEHICLES
R. Ross *In* AFSC, Wright-Patterson AFB, Ohio Aerospace Expandable Struct. [1966] p 709–739 (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

Recent developments in lightweight, high strength materials for inflatable structures and their applications are reviewed. Combination balloon and parachute structures for earth atmosphere flights and for extraterrestrial flights are described. Inflatable stilts for aircraft support in rough seas are mentioned. Airmat weaving technology, airmat applications for wing seal, a land plane hull for sea based operations, the inflatable glider, and the inflatable communications drone are considered. The application of airmat to the rotor blade for a compound helicopter is discussed. The successful use of large balloons in the logging industry is reported, and the use of balloons for tethering applications is indicated. N.E.N.

N66-27433# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ZOND-3—UNIVERSAL SCOUT OF THE UNIVERSE
20 Jan. 1966 6 p Transl. into ENGLISH from Pravda Vostoka (USSR), 25 Aug. 1965 p 3
(FTD-TT-65-1502/1+4; TT-66-60992; AD-630976) CFSTI: HC $1.10/MF $0.50

A popularized account is given of experiments performed by Zond-3, the probe which carried out the second successful Soviet attempt to photograph the reverse side of the moon.
TAB

N66-27749*# Schjeldahl (G. T.) Co., Northfield, Minn.
DEVELOPMENT OF A 425 FOOT DIAMETER PASSIVE COMMUNICATION SATELLITE WITH SELF ERECTING PROPERTIES Monthly Progress Report No. 21M, Feb. 1966
William Jacobi [1966] 19 p *Its* Quarterly Rept.-6
(Contract NAS5-3943)
(NASA-CR-75446) CFSTI: HC $1.00/MF $0.50 CSCL 22B

Processing equipment modifications are outlined, and it is pointed out that under normal operating conditions the equipment can deposit copper electrodelessly, and prime coat a mesh with room temperature vulcanized silicone rubber. Mesh resistance has been in the 0.1 to 4.0Ω/sq range; the copper is coated immediately to prevent oxidation. Glass fiber was woven into a fabric with a 10×20 leno weave. The fabric was heat treated to clean it of weaving lubricants, to carmelize the sizing so that subsequent coating will wet the surface more uniformly, and to increase the intrinsic rigidity of the fabric. Measurements showed the rigidity to be markedly increased. Details are also given on coating the heat-treated fabric with an adhesive, which is then cured to alleviate blocking. Microscopic examination showed that the yarns were adequately encapsulated. Plating problems and revised techniques are discussed, and other processing procedures are summarized.
M.G.J.

N66-27885# RAND Corp., Santa Monica, Calif.
AN HELIOCENTRIC EARTH ORBIT PRECURSOR PLANETOID
A. I. Robinson Apr. 1966 9 p
(P-3343; AD-631131) CFSTI: HC $1.10/MF $0.50

The paper sets down some preliminary thoughts on the desire and need for a Heliocentric Earth Orbit Precursor Satellite.
TAB

N66-27979# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.
PASSIVE DAMPING OF AN ORBITING SPACE VEHICLE
P. H. Savet May 1966 22 p refs
(RM-324)

It is shown that an oscillating, gravity gradient stabilized satellite cannot be damped directly by viscous velocity-dissipation. Considering the common features of frequency modulation schemes, however, damping is achievable. An overall analysis of damping characteristics is offered, and two selected schemes are studied. The analysis of these schemes reveals that a parametric damping is not only feasible, but that the time constant of energy decay lends itself naturally to optimization. An explicit result of an optimized design is offered and an analytical expression of the overall damping rate is derived. It is shown that stringent damping requirements lead to gyroscopic instrumentations that accommodate low enough modulation frequencies, consistent with the high rates of energy dissipation practically desired. Author

N66-28031*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
ENVIRONMENTAL TEST OF NIKE APACHE ROCKET NASA 14.111 GT
J. A. Sterhardt Jun. 1965 95 p refs
(NASA-TM-X-55494; X-671-65-236) CFSTI: HC $3.00/MF $0.75 CSCL 22D

A Nike Apache rocket, NASA 14.111 GT, was fired from Wallops Island, Virginia on 31 October 1963 at 2117 Z with a special instrumented payload in order to obtain actual environmental data of a Nike Apache payload during launch and flight. The test was initiated by the Test and Evaluation Division of Goddard Space Flight Center, to obtain vibration, shock and thermal data during launch and flight. The Sounding Rocket Branch added instrumentation to obtain roll, yaw and pitch data, the determination of the stresses in the payload housing shell, and qualification test of a PPM telemetry unit. All test instrumentation functioned perfectly. This report summarizes the data obtained during launch and flight. Author

N66-28036*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
MANUAL CONTROL OF HIGH-ALTITUDE APOLLO LAUNCH ABORT
Alfred J. Meintel, Jr., Kenneth R. Garren, and Norman R. Driscoll Washington, NASA, Jun. 1966 40 p refs
(NASA-TN-D-3433) CFSTI: HC $2.00/MF $0.50 CSCL 22B

A fixed-base simulation study has been conducted to determine whether a pilot could manually orient the Apollo vehicle to the proper reentry attitude following a high-altitude (120,000 feet (36,576 m) and above) abort from earth launch by using only the "out-the-window" visual scene as an attitude reference. The effects of different visual scenes, vehicle control-system failures, and various aerodynamic characteristics caused by different launch vehicles and abort altitudes were investigated. The results of over a thousand simulation runs show that manual orientation is possible but can be critical for certain abort conditions when control-system failures are present.
Author

N66-28064 Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
SATURN DATA SUMMARY HANDBOOK
1 Oct. 1965 164 p

This handbook contains a technical data summary for the Saturn S-IV and S-IVB stages of the Apollo project. Material contained in the S-IVB stage section includes the S-IB and S-V vehicles. The appendix contains aerospace fluid characteristics, LOX and LH_2 vapor pressure curves, and a list of non-standard abbreviations. The family of Saturn launch vehicles and a visual size comparison to the Washington National Monument are shown.
R.N.A.

N66-28116# General Electric Co., Philadelphia, Pa. Missile and Space Div.
STABILIZATION AND CONTROL SUBSYSTEM FLIGHT UNIT B (FU-B) SYSTEM REORIENTATION SUBSEQUENCE ORBITING ASTRONOMICAL OBSERVATORY System Acceptance Test Report
12 Oct. 1965 116 p Prepared for Grumman Aircraft Eng. Corp.
(Doc.-65SD4411)

Included in the reorientation subsequence is that portion of the over-all OAO attitude control sequence from coarse attitude hold through the reorientation, and settling back into

the coarse attitude hold mode at the new vehicle attitude. The ±2° slews in pitch and yaw were each completed in less than 28 seconds (44 second requirement). Two +2° and one −4° slews were successfully completed in both the pitch and the yaw axes. Two +7.5° and one −15° slews were successfully completed in the roll axis. A disturbance jet was fired in each axis causing a greater than 40% change in fine wheel speed. Each time the vehicle returned to the FRZP. The disturbance jet tests were repeated at marginal star tracker gimbal angles. Each of these tests was also successful. All the reorientation system acceptance test requirements were successfully completed. Author

N66-28328# Royal Aircraft Establishment, Farnborough (England).
TABLE OF THE EARTH SATELLITES LAUNCHED IN 1957–65
D. G. King-Hele and Eileen Quinn Mar. 1966 126 p refs (RAE-TR-66077) CFSTI: HC $4.00/MF $1.00

All known artificial satellites launched before 1 January 1966 are listed chronologically. Lifetimes, weights, dimensions and orbital details are given for instrumented satellites and their final-stage rockets. Other fragments from satellites are listed without these details. The methods used in compiling the table are described. Author

N66-28373*# National Aeronautics and Space Administration, Washington, D. C.
NEW SYSTEM FOR APPROACHING THE DESIGN OF SOUNDING ROCKETS [SU UN NUOVO METODO PER L'IMPOSTAZIONE DEL PROGETTO DEI MISSILI SONDA]
Ernesto Gismondi Jun. 1966 35 p refs Transl. into ENGLISH of a paper presented at the 13th Intern. Conf. on Commun., Genoa, 12–16 Oct. 1965
(NASA-TT-F-10202) CFSTI: HC $2.00/MF $0.50 CSCL 22D

A description is given of a simple calculation method which enables a designer to pinpoint the principal characteristics of a rocket meeting the requirements laid down by the design problem for a single-stage rocket in vertical ascent. The method can be used also to compare the influence of some parameters on the characteristics and performance of a rocket. Author

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N66-27036*# National Aeronautics and Space Administration, Washington, D. C.
DYNAMICS OF VISCOELASTIC SHELLS AND PLATES [DINAMIKA UPRUGO-VYAZKIKH OBOLOCHEK I PLASTIN]
E. I. Grigolyuk 20 Aug. 1981 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 138, no. 6, 1961 p 1317–1320
(NASA-TT-F-8058) CFSTI: HC $1.00/MF $0.50 CSCL 20K

The general theory of oscillations of viscoelastic shells is described in the present paper. The material of the shell is considered isotropic, homogeneous, and dependent upon the linear relationship between three tensors—stress velocity and deformation velocity. Lyava–Kirchhoff hypotheses are valid for the shell. The shell is considered sloping, the shifting of its surface's median part being small. A system of differential equations of the problem is obtained. It is solved in the case of a circular cylindrical shell flown around by a supersonic gas stream along its genetratrix. Author

N66-27063*# Bell Aerosystems Co., Buffalo, N. Y.
STRUCTURAL AND DYNAMIC ANALYSIS OF THE APOLLO AFT HEAT SHIELD Final Report, Sep. 12, 1964–Mar. 1, 1966
R. H. Gallagher, R. A. Gellatly, and J. R. Batt Dec. 1965 157 p refs
(Contract NAS9-3528)
(NASA-CR-65364; D7218-933004) CFSTI: HC $5.00/MF $1.00 CSCL 22B

Analyses are performed of the Apollo aft heat shield for conditions of water impact and thermal stress. The water impact condition is first treated as a quasi-static problem in the determination of localized stresses of a critical nature. Two separate temperature profiles are examined in the solution for thermal stresses. Dynamic response and elastic instability analyses are performed for a limited number of conditions in order to confirm the influence of these effects with respect to the quasi-static solution. The concepts of discrete element analysis, as they pertain to the Apollo aft heat shield, are reviewed and more advanced and satisfactory idealization procedures are defined. Author

N66-27069*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
PROJECTILE-IMPACT-INDUCED FRACTURE OF LIQUID-FILLED, FILAMENT-REINFORCED PLASTIC OR ALUMINUM TANKS
Francis S. Stepka Washington, NASA, Jun. 1966 22 p refs
(NASA-TN-D-3456) CFSTI: HC $1.00/MF $0.50 CSCL 20K

An experimental evaluation was made of the impact-fracture characteristics of liquid-filled tanks with walls of several filament-reinforced plastic materials. Comparisons were also made with tank walls made of an aluminum alloy. The materials evaluated were glass-filament-reinforced urethane or epoxy, dacron-filament-reinforced urethane, steel-wire-reinforced urethane, and 2014-T6 aluminum alloy. The liquid contained in each tank was either water or liquid nitrogen. The impacting projectiles were 7/32-inch-diameter spheres of steel or aluminum, which were accelerated to velocities of 5500 and 6500 feet per second, respectively. The glass-reinforced plastics were most resistant to impact-fracture damage; the dacron-reinforced urethane was least resistant. The glass-reinforced plastic walls were also more resistant to fracture than the aluminum alloy walls. Impacts into liquid-nitrogen-filled cylindrical tanks with approximately 1/32-inch-thick walls of these materials resulted in bursting of an aluminum wall stressed prior to impact to only 10% of the material ultimate strength, compared with only a puncture and local delamination of the outer filament layer of glass-reinforced epoxy walls stressed prior to impact to as high as 40% of the material ultimate strength. Author

N66-27070*# Minnesota Univ., Minneapolis.
ON DEFORMATION AND STRENGTH
C. C. Hsiao and C. S. Ting [1965] 11 p refs Presented at the Intern. Conf. on Fracture, Sendai, Japan, Sep. 1965
(Grant NGR-24-008-070)
(NASA-CR-67877) CFSTI: HC $1.00/MF $0.50 CSCL 20K

The mechanical strength of a medium is formulated in terms of microscopic behavior in the continuum. Both deformation and orientation of the microscopic elements are considered in the formulation. It is shown that the representation of the complicated time-dependent macro-modulus functions can be greatly simplified through the use of micro-behavior. The time-dependent macroscopic fracture strength is also obtained using microscopic considerations. The fracture strength is found to be linearly related with logarithm of time for large loads. Author

N66-27222*# National Aeronautics and Space Administration, Washington, D. C.

INFLUENCE OF INTERNAL PRESSURE ON THE CRITICAL SHEAR STRESS FOR AN INFINITELY LONG CYLINDRICAL SHELL

L. A. Shapovalov [1960] 6 p ref Transl. into ENGLISH from Prikl. Mat. i Mekh. (Moscow), v. 20, no. 5, 1956 p 669-671 (NASA-TT-F-8470) CFSTI: HC $1.00/MF $0.50 CSCL 20K

A mathematical solution is derived for the minimum critical shear stress for an infinitely long cylindrical shell under torsion and combined torsion and internal pressure. From the derived trinomial equation $\phi = L(\lambda,n)\phi_1 + M(\lambda,n)\alpha + N(\lambda,n)$, the minimum value of the critical shear stress is determined. Analysis of these results show that the critical torsional load increases substantially in the presence of internal pressure. N.E.A.

N66-27245*# Washington Univ., Seattle. Dept. of Aeronautics and Astronautics.

PHOTOTHERMOVISCOELASTICITY II Status Report, 1 Oct. 1965-1 Apr. 1966

R. J. H. Bollard and E. H. Dill Apr. 1966 124 p refs (Grant NsG-401)
(NASA-CR-75321) CFSTI: HC $4.00/MF $1.00 CSCL 20K

This report presents the status of a study to establish a procedure for stress analysis of a viscoelastic structure subject to transient temperature and time dependent loadings. Further work on the linear viscoelastic problems and modifications to the photoelastic bench are described. The direct data reduction from a viscoelastic test using a uniaxial test specimen as an analog computer is presented. Several problems which illustrate photoviscoelastic procedures are solved. The extension of the embedded polariscope method to low modulus material is described. A viscoelastic problem with nonuniform temperature distribution is solved. An invention is described, for extending the photoviscoelastic method to dynamic loading, in which the polarization plane of a polarizer is rotated electronically. The fundamental theory for the study of nonlinear viscoelasticity and elasticity problems is presented. The nature of constitutive relations for the mechanical and electromagnetic behavior of high polymers experiencing large strains is derived. The use of such relations for a given material to solve stress analysis problems for nonlinear viscoelasticity and elasticity by an extension of photoelasticity is indicated. R.N.A.

N66-27265# Argonne National Lab., Ill.

THREE-DIMENSIONAL STRESS CONCENTRATION AROUND A CYLINDRICAL HOLE IN A SEMI-INFINITE ELASTIC BODY

Carl K. Youngdahl and Eli Sternberg (Calif. Inst. of Tech.) Sep. 1965 159 p refs (Contract W-31-109-ENG-38)
(ANL-7097) CFSTI: HC $5.00/MF $1.00

Included is a three-dimensional solution, exact within classical elastostatics, for the stresses and deformations arising in a half-space with a semi-infinite transverse cylindrical hole; if the body—at infinite distances from its cylindrical boundary—is subjected to an arbitrary, uniform plane field of stress that is parallel to the bounding plane. The solution in integral form was deduced with the aid of the Papkovich stress functions by means of an especially adapted, unconventional integral-transform technique. Numerical results for the nonvanishing stresses along the boundary of the hole and for the normal displacement at the plane boundary, corresponding to several values of Poisson's ratio, are also included. These results exhibit in detail the three-dimensional stress boundary layer that emerges near the edges of the hole in the analogous problem for a plate of finite thickness, as the ratio of the plate thickness to the diameter of the hole grows beyond bounds. The results obtained illustrate the limitations inherent in the two-dimensional plane-strain treatment of the spatial plane problems; in addition, they are relevant to failure considerations and are of interest in connection with experimental stress analysis. Author (NSA)

N66-27266# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Aero Propulsion Lab.

AEROSPACE EXPANDABLE STRUCTURES

[1966] 803 p refs Trans. of the 2d Conf. held at Minnetonka Beach, Minn., 25-27 May 1965 Sponsored in cooperation with Archer-Daniels-Midland Co.
(AFAPL-TR-65-108; AD-631406) CFSTI: HC $11.00/MF $3.25

Conference papers on research in the field of expandable structures are presented. For individual titles see N66-27267-N66-27302.

N66-27267# Air Force Systems Command, Wright-Patterson AFB, Ohio.

EXPANDABLE STRUCTURE CONCEPT OF CREW TRANSFER TUNNEL FOR SPACE VEHICLES

F. W. Forbes, J. Schofield, N. F. Hribar (Aerospace Corp.) and L. Jurich (Goodyear Aerospace Corp.) *In its* Aerospace Expandable Struct. [1966] p 1-18 (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

The concept of an expandable, multi-ply elastic structure is discussed for applications to crew transfer tunnels, air locks, and maintenance hangers for vehicles in space. In addition, the general design of an expandable crew transfer tunnel, derived under constraints imposed by human factors and the mission requirements for crew transfer between spacecraft and orbital laboratories, is presented. The tunnel is to be structured as follows: (1) an innermost pressure bladder consisting of Capran film sandwiched between lightweight nylon cloth; (2) a seamless structural layer consisting of a four-ply laminate of dacron bonded to a polyester resin; (3) a two-inch layer of flexible polyether foam; and (4) an outer cover, again consisting of the nylon cloth-Capran film-nylon cloth laminate, but in this instance coated with zinc oxide pigment and silicone resin to provide thermal protection. D.T.

N66-27269# Geophysics Corp. of America, Anoka, Minn. Viron Div.

THE APPLICATION OF EXPANDABLE HONEYCOMB TO THE FABRICATION OF SPACE STRUCTURES

Ivan R. Russell and Charles Koons (AFSC, Wright-Patterson AFB, Ohio) *In its* Aerospace Expandable Struct. [1966] p 51-71 (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

Structural plastic materials and design concepts are discussed, and experiments are reported for an expandable space structure which has a small packaging volume and which can be transported into a desired position in a fully assembled configuration. In addition to the small packaging volume it is to have a high strength-to-weight ratio. The following conclusions and results are presented: (1) The expandable honeycomb structure was found to be a feasible approach to providing expandable structures for space and remote area use. Large load carrying structures and solar collectors which require a great degree of accuracy are all within fabrication and rigidization limits. (2) A number of plastic resin systems which are satisfactory for space application were developed. The most promising appear to be a vapor cured urethane system and a gelatin plasticizer boil-off system. D.T.

N66-27270# Cincinnati Univ., Ohio. Coll. of Design, Architecture, and Art.
LIGHTWEIGHT, EXPANDABLE SUPPORT SHELTER SYSTEMS
James M. Alexander *In* AFSC, Wright-Patterson AFB, Ohio Aerospace Expandable Struct. [1966] p 75–103 (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

Structural materials and design concepts are discussed for lightweight expandable support shelter systems. The shelters are intended for use in limited warfare situations in remote areas. The design objectives and capabilities are named for both small and large shelters, i.e., up to 16 ft and 50 ft, respectively. Those for the small shelter are: (1) capability to sustain five erection and disassembly cycles; (2) useful erected life of up to two years; (3) wind load capability to 50 knots; (4) live load capability of five to eight pounds per square ft; and (5) capability to be insulated. In addition, the small shelter structure should be easily expandable in length, and should be easy to construct. The objectives for the large shelter are: (1) live load capability of twenty pounds per square foot; (2) wind load capability to 80 knots; (3) temperature range from −25° to 125°F; and (4) minimum total weight, package cubage, and erection. A number of concepts were structurally tested, and it is reported that good results were obtained. D.T.

N66-27271 Cincinnati Univ., Ohio.
BARE BASE DEVELOPMENT CONCEPTS
Karl H. Merkel, James M. Alexander, and Gilbert C. Born *In* AFSC, Wright-Patterson AFB, Ohio Aerospace Expandable Struct. [1966] p 105–139 refs (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

Four problems were posed for the design, development, construction, and operation of a complete tactical air base starting from an airstrip with no support facilities whatever. It is required that the base be in full operation no later than 30 days after the initiation of construction. The base is to be adequate for a complement of 1100 men, together with the necessary aircraft, shelters, and full support facilities and equipment. The problems were: (1) a site development plan, in model form with movable components, showing shelters, vehicles, and equipment; (2) the design of a shelter system, showing in model form or drawings the procedures of packaging, handling, erection and disassembly of the shelters; (3) the design of a multipurpose land vehicle to accomplish normal transportation and other functions around and airfield; and (4) a complete survey of equipment needs, including drawings, for such items as airfield lighting, fuel handling equipment, personal equipment, and others. D.T.

N66-27272# General Dynamics/Convair, San Diego, Calif.
"RATIO" AUTOMATED ASSEMBLY TECHNIQUE FOR SPACE STRUCTURES
Paul Slysh *In* AFSC, Wright-Patterson AFB, Ohio Aerospace Expandable Struct. [1966] p 141–163 ref (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

A technique is described for implementing the automatic or semiautomatic assembly of large space structures. The technique includes breaking down the structure into modules capable of being tested, and establishing the mechanisms for the automatic or semiautomatic assembly of the modules. The modules and the full structures may be expandable or rigid. It is pointed out that the technique is applicable to the deployment of such structures as reflectors for antennas and solar concentrators, booms, extended-area solar panels, and cylindrical, lenticular and toroidal space stations and reentry bodies. An application to the deployment of a paraboloidal reflector is presented. D.T.

N66-27275# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
STRUCTURAL CONSIDERATIONS FOR AN EXPANDABLE LENTICULAR SATELLITE
Jerry L. Humble *In* AFSC, Wright-Patterson AFB, Ohio Aerospace Expandable Struct. [1966] p 199–213 (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

The structural concepts and considerations are presented for a lightweight, expandable lenticular passive communications satellite. In addition, the satellite is to be gravity gradient stabilized and is to have orbital position control capability. It is noted that preliminary investigations indicate the feasibility of the total lenticular concept. It was also demonstrated that using the lenticular shape a passive communications satellite can be produced with capabilities superior to those of a spherical satellite of the same weight. The various materials and loads which may be used in the construction of a lenticular satellite are discussed, along with the packaging and deployment procedures and operations. D.T.

N66-27276# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
APPLICATION OF INFLATABLE STRUCTURES TO STATION KEEPING OF PASSIVE COMMUNICATIONS SATELLITES
John E. Cooper *In* AFSC, Wright-Patterson AFB, Ohio Aerospace Expandable Struct. [1966] p 215–233 refs (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

The feasibility of using the passive solar radiation force and the satellite's reradiated thermal emission force to perform orbit positions control was demonstrated. This allows station keeping of low density Echo type spherical and lenticular passive communication satellites by controlling the orbital energy and thereby controlling the orbit period of the satellites. The studies showed that the technique depends on the use of large area-to-mass ratio satellites, and is therefore applicable to inflatable, expandable, and erectable structures in space. The mobility of any given satellite is dependent upon the differences achieved in solar reflectance, absorptance, and thermal emittance through the use of various lightweight coatings. In addition, semipassive attitude stabilization and damping systems were shown feasible for the lenticular satellite using the same solar and reradiated emission forces. It is noted that studies thus far completed were limited to the low altitude 2000 nautical mile range. D.T.

N66-27278# Philco Corp., Palo Alto, Calif. WDL Div.
BENDING OF UNFURLABLE TUBULAR STRUCTURES IN SPACE

George G. Herzl *In* AFSC, Wright-Patterson AFB, Ohio Aerospace Expandable Struct. [1966] p 249–263 refs (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

The major causes of both localized and gradual bending of unfurled booms in space were investigated. The following conclusions were reached: (1) Localized bending occurs during boom deployment and is due to inertial and Coriolis forces, rebound at the end of deployment, and localized cold welding. The deformation may in the worst cases lead to total failure of the boom, but is in all cases predictable and preventable. (2) Gradual boom bending is due to initial distortion, orbit dependent distortion, and slowly induced distortion due to space exposure. Gradual bending cannot be entirely eliminated, and thus the object of the design is to keep it within tolerable limits. Results of calculations and diagrams are presented for various cases of practical importance. D.T.

N66-27279# Computing Devices of Canada, Ltd., Ottawa (Ontario).

DEVELOPMENT AND EVALUATION OF A RIGIDIZED INFLATABLE MICROWAVE REFLECTOR

K. F. Gibson and G. M. Peace (Bendix Corp.) *In* AFSC, Wright-Patterson AFB, Ohio Aerospace Expandable Struct. [1966] p 265–287 refs (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

Techniques were developed for the construction and assembly of an inflated rigidized microwave reflector; and its performance was evaluated. In its simplest form the reflector is made by bonding polyester film to the top and bottom surfaces of flexible support rim. The inner surface of one of films is coated with a metallic reflecting material. Provision is made for feeding a rigidizing agent into the support rim and then into the space between the two membranes which form the front and back surfaces of the reflector. The rigidizer is a low density foaming plastic. Evaluation tests indicate that the surface characteristics, resulting from this method of fabrication and assembly, will permit the reflector to be used satisfactorily at X-band frequencies or lower. It is noted, however, that further refinements in the process, or smaller dish dimensions, might permit the reflector's use for K-band microwaves. D.T.

N66-27281# General Dynamics/Fort Worth, Tex.

AN INFLATABLE THERMAL RADIATION SHIELD FOR SPACE APPLICATIONS

J. E. Marshall *In* AFSC, Wright-Patterson AFB, Ohio Aerospace Expandable Struct. [1966] p 305–338 (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

(Contract NAS8-11317)

A test program was conducted to determine the structural feasibility of a low temperature rigidized inflatable thermal radiation shield for cryogenic fueled space vehicles. Some elastomers were evaluated for use as rigidizing coatings. Model spherical shields coated with a vinyl-base lacquer were rigidized by cooling and centrifuge tested to determine allowable loading. These data are extrapolated for estimation of mass penalty and allowable loading of full scale shields. Results indicate that a 330-inch diameter inflatable spherical shield utilizing the low temperature rigidizing concept would weigh approximately 45 pounds and endure lateral accelerations of about .03 g's. Author

N66-27282# Goodyear Aerospace Corp., Akron, Ohio.

A PREDISTRIBUTED FOAM FOR RIGIDIZING MEMBRANE STRUCTURES IN SPACE

N. Jouriles *In* AFSC, Wright-Patterson AFB, Ohio Aerospace Expandable Struct. [1966] p 339–361 (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

Processing techniques for developing azide-base polyurethane foam are described, and production criteria are defined. These include a triggering temperature of 175°F; sublimation tendency of 10% after 100 hours in vacuum; an azide rearrangement of 50 minutes or less; and heat release of 15 cal per square inch. Setting in 30 minutes and curing in 1 hour were listed for the reaction rate of isocyanate. A hypothetical 300 n. mi. orbit was selected. Aluminized mylar, chromium–nickel–vanadium, cobalt oxide and black surface materials were studied, and results show that the heat requirement can probably be met by painting the surface black and orienting the solar concentrator so that the back side faces the sun for the rigidizing process. Details are also given on tests conducted to determine the physical properties. The data obtained indicate: (1) The foam product has useful structural strength and stiffness in a vacuum up to 240°F for densities greater than 3 lb per cubic foot. (2) The tensile, compression, and shear properties increase with increasing density, and decrease with increasing temperature. (3) Thermal expansion decreases with an increase in density. M.G.J.

N66-27283# Martin Co., Baltimore, Md.

SEMI-RIGID STRUCTURES FOR SPACE APPLICATIONS, EXPANDABLE SPACE STRUCTURE

P. M. Knox, Jr. and R. O. Moses *In* AFSC, Wright-Patterson AFB, Ohio Aerospace Expandable Struct. [1966] p 363–395 (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

(Contract AF 33(657)-9733)

Design, fabrication, and ground testing of a semirigid telescoping expandable space structure (ESS) is described. The requirements for a manned space station were considered in the design of the expandable sections, which could be expanded in orbit to produce useful volume for astronaut occupancy, equipment relocation, and other applications. Thermal control, space radiation, and puncture pressure loss analyses were performed, along with panel sealing, meteoroid penetration, and hypervelocity penetration stressed-panel tests to establish vehicle design criteria. A prototype ESS is depicted, showing an 8-ft diameter vehicle, 15-ft long in the extended configuration and 5 1/2 ft long in the retracted configuration. The telescoping portion, that demonstrates the expandable principle, has five sections, is 32-in. long in the retracted configuration and slightly over 12-ft long when extended; the ratio of expanded to retracted internal volume is 5.45. Candidate construction materials were evaluated, and tests of the completed ESS structure were conducted; the data are graphically depicted. Results show that large size telescoping structures fabricated of individual rigid segments are feasible. M.G.J.

N66-27284# Army Engineer Research and Development Labs., Fort Belvoir, Va.

BUILDINGS IN BARRELS, PART III

S. B. Swenson *In* AFSC, Wright-Patterson AFB, Ohio Aerospace Expandable Struct. [1966] p 397–428 refs (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

The concentrated research into the uses of expandable materials in field fabrication of military structures is reviewed, and the application of this concept to space fabrication of structures is discussed. Details are given on an Arctic building of modular design, using stressed skin panels of reinforced glass fiber with polyurethane foam core; two were erected in 1961. Evaluation tests are discussed, with photographs and

charts included to amplify the text. Efforts to simplify the fabrication, construction, and supporting equipment requirements are discussed, and the resulting improvement in techniques is assessed. It is pointed out that for subsurface lunar installations, where structures are isolated from exterior forces, designs, techniques, and materials would have to be developed which are compatible with the circumstances; and that the inherent structural strength of polyurethane or other foam material developed for space application could conceivably eliminate the need for core facing materials. M.G.J.

N66-27286# Air Force Systems Command, Wright-Patterson AFB, Ohio.

SIMULATION OF METEOROID IMPACT EFFECTS ON EXPANDABLE STRUCTURES

Andre J. Holten *In its* Aerospace Expandable Struct. [1966] p 447–466 refs (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

Details are given on a hypervelocity facility, in which an exploding foil device is used for accelerating the milligram size particles. The facility consists of an electronically-triggered high energy storage system, together with high speed streak and framing photographic instrumentation for measuring particle velocity, size, shape, and momentum. Electronic instrumentation measures capacitor bank discharge characteristics and the energy input to the exploding foil gun. As the gun disintegrates when it is fired, the evacuated gun chamber and gun is housed in a special room to protect equipment and operating personnel. A shielded control room, a dark room, and a data analysis area are also provided. Penetration equations for determining the projectile mass are given, and calculations were made from selected single particle impacts which produced hemispherical craters. The projectiles were mylar 1/4" diameter discs, 0.010" thick, having an initial weight of ~11 mg; average particle mass obtained was 4.8 mg with an RMS error of 25%. Test results of materials for expandable structures are assessed; in general, it was found that damage occurred in the compressed condition but not in the expanded state. M.G.J.

N66-27287# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

DEVELOPMENT OF AN EXPANDABLE AIRLOCK UTILIZING THE ELASTIC RECOVERY PRINCIPLE

Jerry G. Williams *In* AFSC, Wright-Patterson AFB, Ohio Aerospace Expandable Struct. [1966] p 467–496 refs (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

Expandable airlock concepts are discussed in relation to their potential use in such advanced space station projects as the MORL. System components are identified as the structural pressure vessel, environmental protective wall, and deployment system; the criteria for each are summarized. Guidelines for designing an expandable airlock, in which resilient foam is used for elastic recovery deployment, are specified; these include configuration, orbit parameters, thermal control, internal temperature range, structural design, hatch design, leakage, and meteoroid and radiation protection. The materials which comprise the airlock wall are divided into four major functional categories: the outer thermal control surface, layers for micrometeoroid protection and thermal insulation, structural fabric, and an inner impervious liner. It was pointed out that the composite wall must have sufficient foam thickness, and must maintain flexibility. Study results indicate the feasibility of using the stored potential energy of a compressed foam for deployment; the foam was also found to provide micrometeoroid protection and thermal control insulation. M.G.J.

N66-27288# North American Aviation, Inc., Los Angeles, Calif.

POTENTIAL APPLICATIONS FOR EXPANDABLE AND INFLATABLE STRUCTURES FOR RE-ENTRY VEHICLES

R. P. Wykes *In* AFSC, Wright-Patterson AFB, Ohio Aerospace Expandable Struct. [1966] p 497–518 refs (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

The design concepts for reentry vehicles using inflatable and expandable structures and ballute-type drag devices are discussed. It is reported that a large increase in L/D ratio can be obtained by means of extendable surfaces. Aerodynamic heating can be mitigated by deployment of an inflatable, or expandable aerodynamically stable, high drag device, which also controls reentry angle of attack. The 80-degree conical ballute, spherical ballute, and spherical segment ballute were investigated. The most suitable materials for the ballute were considered to be boron-based fibers and nickel-based superalloys in ultrafine filament for woven into a mesh. The stowing of the device in the vehicle tail, and its inflation are mentioned. Drag control and problems connected with trailing drag units are outlined. The use of a double-walled, inflatable structure (airmat) was studied. It is concluded that the inflatable, expandable device has potential for space and reentry vehicle structures. N.E.N.

N66-27289# Goodyear Aerospace Corp., Akron, Ohio.

COMPRESSION TESTS OF WIRE-FILM CYLINDERS

Earl Rottmayer *In* AFSC, Wright-Patterson AFB, Ohio Aerospace Expandable Struct. [1966] p 519–535 refs (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

The fabrication and testing of a wire-film composite cylinder is reported. Specimens of Mylar lined with stainless steel, aluminum, and copper wires were constructed. The rigidization pressure, buckling stress, axial stiffness and packaging effects were investigated. Graphed and tabulated data are presented. The following conclusions were reached: the optimum rigidization pressure is the one producing yield stress or buckling of the wire, whichever is smaller; the local buckling constant is 1.5; an effective axial stiffness of 50% of the calculated value can be achieved; and packaging has little effect on axial stiffness or buckling load. N.E.N.

N66-27290# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

DESIGN CRITERIA FOR INFLATED, EXPANDABLE BEAMS USED AS STRUCTURAL MEMBERS IN AN ADVANCED CONCEPT PARAGLIDER

Royce A. Toni and James F. Mc Nulty *In* AFSC, Wright-Patterson AFB, Ohio Aerospace Expandable Struct. [1966] p 537–554 refs (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

The analytical design procedures to be utilized after establishing the loading condition for the inflated, expandable beams are presented. The longitudinal shape, load, and cabling of the high aspect ratio paraglider are described. A rigid model was wind tunnel tested over a range of angles of attack, and the resulting load and moment coefficients were recorded for each structural member and for various stations along its length. This load data served as the design criteria and dictated the leading edge internal pressure requirements to resist wrinkling. The inertia loads, weight distributions, and shroud line load

distribution are mentioned. Basic equations applicable to a circular cross section beam design are developed for the area, moment of inertia, static moment of inertia of arc, and torsional shear stress. Analytical formulas are presented for determining (1) the inflation pressure for the leading edges under which the edges will not buckle, and (2) the keel radius which assures that the keel will not buckle. N.E.N.

N66-27291# Hughes Aircraft Co., Culver City, Calif. Materials Technology Dept.

DEVELOPMENT OF SPACE EXPANDED AND RIGIDIZED SOLAR ENERGY COLLECTORS

Seymour Schwartz *In* AFSC, Wright-Patterson AFB, Ohio Aerospace Expandable Struct. [1966] p 555–571 refs (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

The fabrication and testing of inflatable solar concentrators are described. The design is a paraboloid, with a reflective surface of 1 aluminized polyester film, and an outer pressure membrane of clear polyester film. The film surfaces are formed from hexagonals joined by a heat sealing technique. Problems connected with the rigidization of the polyester resin, polysulfide gels, epoxy resin, and epoxy syntactic foam are discussed. It was found that the rigidization of epoxy syntactic foam on the aluminized polyester film produced the best optical results. Difficulties encountered when rigidization of polyester and epoxy was attempted in vacuum are described. Packaging, expansion, and rigidization capabilities were demonstrated for paraboloids with the epoxy syntactic foam and with a film reinforced with fiber glass laminate. The epoxy syntactic foam was heavier, but appeared to give better results. Further tests on the rigidized polyester and epoxy syntactic foam indicated that the polyester lost more weight and showed surface wrinkling after ultraviolet irradiation, and that the epoxy foam showed greater reflectivity and greater calorimetric efficiency. N.E.N.

N66-27292# AVCO Corp., Wilmington, Mass. Research and Advanced Development Div.

ALUMINUM FOIL EXPANDABLE STRUCTURE

S. Motta *In* AFSC, Wright-Patterson AFB, Ohio Aerospace Expandable Struct. [1966] p 573–602 ref (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

The feasibility of using aluminum foil to fabricate expandable space structures was investigated. Details are given of the forming and testing of a foil structure, and test data is presented in graph and tabular form. Difficulties encountered with the foil are discussed and include foil thickness, variation in thickness, tiny perforations versus thickness, an stress–strain of foil versus thickness. The techniques of seam bonding of foil edges for the tubular member by electron beam welding, and of the fabrication of a toroid of circular cross section are described. It was concluded that foldable structures of appreciable strength and rigidity can be achieved with a metallic foil. N.E.N.

N66-27294# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MEMBRANE ANALYSIS OF PRESSURIZED THIN SPHEROID SHELLS COMPOSED OF FLAT GORES, AND ITS APPLICATION TO ECHO II

Hossein Bahiman and John M. Thole *In* AFSC, Wright-Patterson AFB, Ohio Aerospace Expandable Struct. [1966] p 617–631 refs (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

The computation of the shape of the pressurized shell is based on the solution of five nonlinear partial differential equations of equilibrium and boundary conditions for the three displacements of a gore. The approximate solution of the equations by perturbation technique was performed, and resulted in three displacement functions of the gore with one unknown constant. This constant was evaluated by applying the variational method to the total elastic strain and potential energy of the system. It was assumed that the displacement of the spheroid due to the gravity is negligible compared to the one caused by the constant internal pressure, and that the material of the spheroid is homogeneous and isotropic, and obeys Hooke's law. It is concluded that this technique gives a good approximation of the maximum differential radial displacement of a pressurized spheroid in a zero gravity field. N.E.N.

N66-27298# Martin Co., Baltimore, Md.

SATELLITE APPLICATIONS FOR EXPANDABLE SPACE STRUCTURES

H. S. Zahn *In* AFSC, Wright-Patterson AFB, Ohio Aerospace Expandable Struct. [1966] p 687–707 (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

Unmanned applications of expandable space structures for use in space radiation, thermal control, and other experiments are investigated. The construction and operation of the structure are outlined. An experiment to conduct realistic simulation of space cabin environment and measurement of space radiation effects, using a tissue equivalent plastic manikin (plastinaut) and associated radiation sensors is considered. Possible experiments to determine micrometeoroid effects and the effectiveness of thermal coatings and cooling systems are also discussed. The configurations for a minimum test, the radiation dosage test, and a long duration test (with a plastinaut and reentry vehicle) are described. Additional applications are indicated. N.E.N.

N66-27300# AVCO Corp., Wilmington, Mass. Research and Advanced Development Div.

CORRELATION OF ANALYTICAL AND EXPERIMENTAL RESULTS OF CYLINDRICAL SHELLS UNDER NEWTONIAN PRESSURE DISTRIBUTION

Nicholas C. Lycurgus and Wesley R. Midgley *In* AFSC, Wright-Patterson AFB, Ohio Aerospace Expandable Struct. [1966] p 740–767 refs (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

Tests were performed to determine whether or not linear extensional shell theory is applicable to the analysis of cylindrical shells constructed of unfurlable wire cloth material and subjected to Newtonian type pressure distribution. Since the objective was to compare test results with results obtained through the application of linear extensional shell theory, the analysis and testing were performed on a stainless steel foil shell, which eliminated the problem of non-isotropy of the wire cloth material. It is expected that a similar comparison will be performed at a later date using wire cloth. The comparison of analytical with test results, as well as the analytical results themselves, shows that linear extensional shell theory is applicable to the analysis of steel foil cylindrical shells under Newtonian pressure distribution. Author

N66-27302# Air Inflatable Products Corp., New Haven, Conn.

DUAL WALL INFLATABLE STRUCTURES FOR SPACE ORIENTED APPLICATIONS

Herbert O. Bair and William H. Fischer *In* AFSC, Wright-Patterson AFB, Ohio Aerospace Expandable Struct. [1966] p 785–802 (See N66-27266 15-32) CFSTI: HC $11.00/MF $3.25

The wing tab technique for dual wall structures is defined as a method whereby the attachment flange for the web is an integrally woven portion of the skin material, thus virtually eliminating stress concentrations. An outer and inner skin of airtight fabric are used, with the skins held in position by either vertical or horizontal webs depending upon the structure configuration and operational requirements. General design parameters for radome construction are discussed, along with the construction details. The equations used in a stress analysis are given; findings show that the ratio of fabric stresses is on the order of 1 to 7 depending on wind velocity. The electrical properties of dual wall radomes were also found to be very similar to single wall radomes; a figure is included to give an indication of radome size to electrical properties by depicting the difference in the curve slopes of size to overall material gauge. Among the potential applications listed for the dual wall concept are radomes for satellite tracking stations, environmental control areas, housing or operations shelters, moon or planetary shelters, and orbital repair or maintenance structures. M.G.J.

N66-27310*# AVCO Corp., Lowell, Mass. Research and Technology Labs.

STUDY OF METEOROID IMPACT INTO ABLATIVE HEAT SHIELD MATERIALS Final Report

R. R. Mc Math, R. F. Suitor, L. L. Lander, and E. Langberg Apr. 1966 409 p refs

(Contract NAS9-3404)

(NASA-CR-65375; AVSSD-0002-66-RR) CFSTI: HC $7.09/MF $2.00 CSCL 20K

Meteoroid impact damage to Apollo and Gemini heat shield material has been experimentally and analytically studied. Hypervelocity impact tests were performed on these materials both in honeycomb and as tiles at room temperature and at temperatures down to −250°F. Projectiles of aluminum and Delrin were used to investigate the effect that changing projectile density would have on impact damage. Impact velocities varied from 3 km/sec to 8 km/sec. The data from this extensive parametric study were treated with a regression analysis on the 7094 computer to determine the best curve fit to the data. Combined with an analysis of the hypervelocity impact process in these materials, this resulted in equations that permit prediction of impact damage to these heat shields. Author

N66-27418# Polytechnic Inst. of Brooklyn, N. Y. Dept. of Aerospace Engineering and Applied Mechanics.

INVESTIGATION OF PLATES AND SHELLS UNDER EXTERNAL LOADING AND ELEVATED TEMPERATURES Final Report for 1965

Joseph Kempner Mar. 1966 19 p refs

(Contract AF 49(638)-1360)

(PIBAL-915; AFOSR-66-0610; AD-630623) CFSTI: HC $1.00/MF $0.50

The studies briefly described stem from continuing investigations of plates and shells under external loading and elevated temperatures, and include problems of special interest to designers of missiles and aircraft. Chapter I discusses the post-buckling (large-deflection theory) of noncircular (oval) cylindrical shells under axial compression. Chapter II describes work on the analysis of the effects of concentrated loads applied to reinforcing frames of finite and infinitely long circular cylindrical shells. Chapter III presents the results of investigations of the effects of creep in structures, with particular emphasis on the bending of uniform and variable thickness circular plates and the effects of concentrated loads. Author (TAB)

N66-27428# New York Univ., N. Y. Dept. of Aeronautics and Astronautics.

SHAPE AND STRESS ANALYSIS OF ROTATIONALLY SYMMETRIC BALLOONS

Arnold D. Kerr and Harold Alexander Sep. 1965 32 p refs

(Contract AF 19(628)-4990)

(NYU-AA-65-11; AFCRL-66-116; AD-630622) CFSTI: HC $2.00/MF $0.50

This report considers the title problem from a general point of view. The governing differential equations are derived; and for specified stress conditions the shape equations which yield 'natural shape' balloons, 'equal strength' balloons, etc., are obtained. Throughout the report the resulting equations are correlated with the corresponding results derived and used by previous investigators. It is pointed out that the tabulated shapes which are used in prescribing the initial shapes of tailored balloons are actually those of deformed balloons. Therefore, when the shape of the balloon floating at altitude differs noticeable from its initial design form because of the deformations of the skin, the desired stress condition will not be realized. Author (TAB)

N66-27473# Southwest Research Inst., San Antonio, Tex.

STUDIES OF THE FATIGUE STRENGTH OF PRESSURE VESSELS. 1: CYCLIC PRESSURE TESTS OF LARGE SIZE PRESSURE VESSELS. 2: LOW CYCLE FATIGUE TESTING OF ONE-HALF SCALE MODEL PRESSURE VESSELS. 3: EFFECT OF WELD DEFECTS ON THE FATIGUE STRENGTH OF A302B STEEL Progress Report No. 17, 18 Sep. 1965–1 Jan. 1966

A. G. Pickett, S. C. Grigory, and C. G. Robinson 1 Jan. 1966 37 p

(Contract AT(11-1)-1228)

(SWRI-1228-1-20; SWRI-1228-2-20; SWRI-1228-5-20) CFSTI: HC $2.00/MF $0.50

Test specimens were fabricated from a ring cut from the shell of the PM-2A model and the mechanical properties measured. Data on the effects of weld defects on the fatigue strength of A302B steel obtained during the current and prior report periods are summarized, but no conclusions given. NSA

N66-27503*# National Aeronautics and Space Administration, Washington, D. C.

BUCKLING AND STEADY FLUTTER OF HEAT-COMPRESSED PANELS IN A SUPERSONIC FLOW [VYPUCHIVANIYE I USTANOVIVSHIYSYA FLATTER TERMICHESKI SZHATYKH PANELEY, NAKHODYASHCHIKHSYA V SVERKHZVUKOVOM POTOKE]

V. V. Bolotin and Yu. N. Novichkov May 1966 27 p refs Transl. into ENGLISH from Inch. Zh. (USSR), v. 1, no. 2, 1961 p 82–96

(NASA-TT-F-10106) CFSTI: HC $2.00/MF $0.50 CSCL 20K

A systematic study of thermal buckling and steady flutter of panels, originally plane and rectangular in planform, based on a previous method for solving nonlinear stability problems of plane panels at high supersonic velocities is given. The form of elastic equilibrium of thermally buckled panels is determined and their stability is investigated. The amplitudes

of the steady flutter are found in second approximation by the small parameter method and by the method of harmonic balance; the values found are mutually comparable. The behavior of panels in a flow under simultaneous variation of flow velocity and panel temperature is discussed. Author

N66-27519# Union Carbide Nuclear Co., Oak Ridge, Tenn. Y-12 Plant
PENETRATION TESTS
W. T. Carey 4 Mar. 1966 17 p
(Contract W-7405-ENG-26)
(Y-1490) CFSTI: HC $1.00/MF $0.50

A test was developed to evaluate the ability of materials to resist penetration by a small-diameter penetrator. The test was developed for use in evaluating high-strength materials. The test results and limitations of the test are presented. Author (NSA)

N66-27545*# J. G. Engineering Research Associates, Baltimore, Md.
PREDICTION OF THE DYNAMIC ENVIRONMENT OF SPACECRAFT COMPONENTS. PART I: GENERAL CONCEPTS AND DESCRIPTION OF COMPUTER PROGRAMS Technical Report No. 5
Joshua E. Greenspon Dec. 1965 25 p refs
(Contract NAS5-9124)
(NASA-CR-75493) CFSTI: HC $1.00/MF $0.50 CSCL 20K

This report discusses the general types of motion involved in spacecraft response and the computer methods and programs for computing both structural and air path response. A discussion of various types of damping is included. A procedure for testing components is proposed which depends in part on the computations obtained from the computer procedures. Author

N66-27571# New Mexico Univ., Albuquerque, Eric C. Wang Civil Engineering Research Facility.
A STUDY OF THE PROPAGATION OF STRESS WAVES IN SAND Technical Report, Jan. 1964–May 1965
Robert L. Mc Neill Kirtland AFB, N. Mex., AF Weapons Lab., Mar. 1966 238 p refs
(Contract AF 29(601)-6002)
(AFWL-TR-65-180; AD-630792) CFSTI: HC $6.00/MF $1.25

The propagation of near-failure, soft-fronted stress waves in 5-foot-long, 1-inch-diameter, unconstrained rods of dry 20–30 Ottawa sand is studied. The input is created by a shock tube, modified to yield soft-fronted, long-duration, air-pressure loadings. Primary data are displacement-time histories from seven stations along the rod, read by light-sensing gages designed for negligible inertia and friction; secondary data are stress-time histories at the input and the rigidly held reaction ends. Static, dynamic, and additional static triaxial data are given. Variables are applied ambient stress and sand density. From findings that the material is strain-rate insensitive and follows Coulomb's failure law at subfailure stresses, the following observations of wave-propagation parameters for above seismic stresses and a specific material condition have been made: (1) wave and particle velocities depend on the one-half power of ambient stress; (2) all energy densities depend on the first power of ambient stress; and (3) energy partitioning and reflection are independent of ambient stress. Effects of density on wave-propagation parameters for the sand and the variables studied are that (1) all increase with increasing density, (2) some are specifically linear on density, and all can be taken as such for engineering purposes, and (3) waveform parameters are much less sensitive to small errors in density than are static parameters. Author (TAB)

N66-27575# Picatinny Arsenal, Dover, N. J. Feltman Research Labs.
USE OF THE KERR EFFECT FOR STUDYING A STRESSED STATE OF THIN-WALLED STRUCTURES
V. M. Nikitin Apr. 1966 9 p refs Transl. into ENGLISH from Zh. Prik. Mekhan. i Techn. Fiz. (Moscow), no. 2, 1963 p 130–131
(PA-TT-7; AD-630650) CFSTI: HC $1.10/MF $0.50

A procedure and apparatus for studying stresses in thin-walled structures by means of the Kerr effect are described and discussed. The Kerr effect, which is based on the phenomenon of artificial double ray refraction in fluids when an electric field is applied to the fluid, is used in solving multidimensional problems in the theory of elasticity. Author (TAB)

N66-27586# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
WEIGHT SAVINGS DERIVED FROM THE USE OF CONTRASTING MATERIALS IN CONVENTIONALLY STIFFENED CYLINDERS
A. Bruce Burns May 1966 39 p refs
(Rept.-6-76-66-2)

A nondimensionalized structural optimization procedure is used to determine the effect on weight of specifying contrasting ring, stringer, and wall materials in J-stiffened, axially compressed cylinders. For conventional materials having modulus-to-density ratios of approximately 10^8 in., lighter elastic designs result when less dense materials are introduced anywhere in the design. Weight savings are proportional to the percentage of the lighter material used. However, since low-density materials usually have relatively low strengths, these materials are not efficient in plastic designs. Two nonconventional materials, beryllium and beryllium-38% aluminum, are studied in combination with aluminum. Aluminum rings may be used in otherwise beryllium or beryllium-38% aluminum designs with small weight penalties. At low loads, weights of designs with aluminum stringers and a beryllium or beryllium-38% aluminum wall, or vice versa, are about midway between the weights for all-aluminum and all-beryllium designs. At high loads, results depend heavily upon strength-density ratios. Author

N66-27587# Bureau of Ships, Washington, D. C.
ON THE FORCES AND HINGE MOMENT OF A STRUT-WING-POD HYDROFOIL ASSEMBLY UNDERGOING RETRACTION IN A BEAM SEA
Samuel M. V. Lum [1965] 45 p refs Presented at Assoc. of Senior Engr. 3d Ann. Tech. Symp.
(AD-630818) CFSTI: HC $2.00/MF $0.50

To examine the structural adequacy and retraction capability of a hydrofoil assembly designed for inboard rotation, it is necessary to determine the external loading first. A simplified theory based on linearized rigid-body dynamics was developed to estimate the forces and hinge moment on a single (port or starboard) strut-foil-pod configuration undergoing retraction while the hull-borne boat is rolling in a beam sea. Utilizing available free-oscillation model test data of a representative hydrofoil craft, engineering 'upper bound' estimates are carried out to demonstrate the theory for the extreme 'foils up' and 'foils down' conditions. Author (TAB)

N66-27604# Carnegie Inst. of Tech., Pittsburgh, Pa. Dept. of Civil Engineering.
EFFECTS OF IMPULSIVE LOADS ON FIBER-REINFORCED CONCRETE BEAMS Final Report
James P. Romualdi and Melvin R. Ramey Oct. 1965 89 p refs
(Contract OCD-PS-64-21)
(AD-630843) CFSTI: HC $3.00/MF $0.75

The study investigates the effects of destructive impulsive loads on concrete made with steel fiber reinforcement. Analysis of the data led to the following conclusions: (1) The impulsive loading does not cause the sudden failure in the beams with fiber reinforced concrete that is observed in the case of conventional concrete beams. (2) The internal resisting moment is significantly greater in the case of beams made with fiber reinforced concrete. (3) Failure of the compressive zone in beams with fiber reinforced concrete is not sudden but is preceded by extensive deformation. (4) The increased tensile strength of fiber reinforced concrete permits its use without special shear reinforcement. TAB

N66-27626# Army Materials Research Agency, Watertown, Mass. Materials Engineering Div.
MEASUREMENTS OF DISPLACEMENTS OF SPHERICAL CAPS DURING SNAP-THROUGH BUCKLING
Jiro Adachi Jan. 1966 15 p
(AMRA-TR-66-03; AD-631301) CFSTI: HC $1.00/MF $0.50

Measurements were made of the dynamic buckling displacements of the surfaces of spherical caps during buckling under uniform external pressure. The report presents initial single-point measurements showing relationships between shell geometry and the magnitude of the surface displacements, velocities, and accelerations during buckling. The report also describes the use of the displacement transducer whose sensing element is a photovoltaic cell. Author (TAB)

N66-27636# North American Aviation, Inc., Columbus, Ohio.
FEASIBILITY OF ARMOR MATERIAL AS BASIC AIRCRAFT STRUCTURE Final Report
D. G. Whinery Fort Eustis, Va., Army Aviation Materiel Labs., Mar. 1966 96 p refs
(Contract DA-44-177-AMC-189(T))
(USAAVLABS-TR-65-5; AD-631467) CFSTI: HC $3.00/MF $0.75

The use of selected armor materials as primary, secondary, and transparent aircraft structure was studied and determined to be both feasible and practical. Solutions to the several problems in design, fabrication, and repair of both opaque and transparent armor are presented. A comparison indicates that use of structural armor instead of kit armor saves 10 lbs. to 62 lbs. for a single-place aircraft subjected respectively to sporadic and to concentrated small-arms fire throughout the lower hemisphere. In addition, an aircraft design using structural armor will have fewer total parts and will have a lower cost unless an unusual pricing structure exists. Ceramic-faced, non-delaminating fiber glass is recommended for minimum weight, for the most effective maintenance of ballistic and structural properties over extended service life, and for face-contours, dual hardness steel armor is recommended for low first cost, for maximum strength, for high hit-density, and for flat or slightly contoured panels. Author (TAB)

N66-27658# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
THE PERPLEXING BEHAVIOR OF THIN CIRCULAR CYLINDRICAL SHELLS IN AXIAL COMPRESSION
Nicholas J. Hoff Feb. 1966 92 p refs Second Theodore von Karman Mem. Lecture of the Israel Soc. of Aeron. Sci.
(Contract AF 49(638)-1276)
(SUDAAR-258; AFOSR-66-0155; AD-631508) CFSTI: HC $9.60/MF $0.75

The development of our knowledge of the buckling of thin-walled circular cylindrical shells subjected to axial compression is outlined from the beginning of the century until the present, with particular emphasis on advances made in the last twenty-five years. It is shown that practical shells generally buckle under stresses much smaller than the classical critical value derived by Lorenz, Timoshenko, Southwell and Flugge. A first explanation of the reasons for the discrepancy was given by Donnell and the problem was explored in detail by von Karman, Tsien and their collaborators. More recently, Yoshimura discovered the existence of an inextensional displacement pattern which the wall of the shell can suddenly assume, and Koiter found an explanation of the sensitivity of the buckling stress to small initial deviations from the exact circular cylindrical shape. In the last few years further interesting discoveries were made in Japan and in California regarding the effects of details of the boundary conditions, and many additional numerical results were obtained with the aid of high-speed electronic digital computers. Improvements in experimental techniques have also contributed significantly to a clarification of the problem and to an establishment of the unavoidable deviations from the exact shape as the major causes of the large differences between theory and experiment. Author (TAB)

N66-27675# North American Aviation, Inc., Columbus, Ohio.
APPLICATION OF APPLIED LOAD RATIO STATIC TEST SIMULATION TECHNIQUES TO FULL-SCALE STRUCTURES. VOLUME II: MATERIAL PROPERTIES STUDIES AND EVALUATION Final Report, Jul. 1964–Oct. 1965
R. W. Gehring and J. A. Lumm Philadelphia, Naval Air Eng. Center, 15 Jan. 1966 68 p refs
(Contract N156-45330)
(NAEC-ASL-1094, Vol. II; AD-631660) CFSTI: HC $6.60/MF $0.75

Volume II contains the tensile program, tabulated data, derivation of Larson-Miller constants and parametric curves, and the relationships between actual stabilizer properties and the tensile coupon data for compatibility in the analytical-experimental phase of the program described in Volume IV. This study was performed on the two main structural materials of the horizontal stabilizer, i.e., 7079-T6 aluminum alloy bare plate and AZ31B-H24 magnesium alloy. Data from other sources was used for 7075-T6, 4340 steel, and stainless steel, and were regarded as sufficiently accurate for the intended usage. Parametric curves with temperature-time exposure defined by the Larson-Miller Parameter are derived for 7079-T6 aluminum alloy where the primary problem is over-aging produced by the elevated temperature test conditions. The curves derived are useful for defining the tensile yield stress and tensile ultimate stress of 7079-T6 aluminum alloy in complex temperature-time environments. No parametric curves are shown for the AZ31B-H24 magnesium alloy since low initial room temperature properties and relative insensitivity to exposure time at elevated temperature prevent an accurate definition of the Larson-Miller constant for this material. Author (TAB)

N66-27688# Technion Research and Development Foundation, Ltd., Haifa (Israel). Dept. of Aeronautical Engineering.
FURTHER REMARKS ON THE EFFECT OF ECCENTRICITY OF STIFFENERS ON THE GENERAL INSTABILITY OF STIFFENED CYLINDRICAL SHELLS Scientific Report No. 2
Josef Singer, Menahem Baruch, and Ovadia Harari Aug. 1965 35 p refs
(Grant AF-EOAR-58-63)
(TAE-42; AFOSR-66-0569; AD-630543) CFSTI: HC $2.00/MF $0.50

The analysis of the general instability of stiffened cylindrical shells under hydrostatic pressure carried out earlier is continued in order to study the inversion of the eccentricity effect. 250 typical shells of varying geometries are considered. The results show that the inversion of the eccentricity effects is practically independent of the geometry of the rings but depends very strongly on the shell geometry parameter Z. A range of inversion is found. A detailed physical explanation of the causes of the eccentricity effect and its inversion is proposed. Author (TAB)

N66-27689# North American Aviation, Inc., Columbus, Ohio.
APPLICATION OF APPLIED LOAD RATIO STATIC TEST SIMULATION TECHNIQUES TO FULL-SCALE STRUCTURES. VOLUME I: METHODS OF ANALYSIS AND DIGITAL COMPUTER PROGRAMS
R. W. Gehring and C. H. Maines Philadelphia, Naval Air Eng. Center, 31 Dec. 1965 106 p refs
(Contract N156-45330)
(NAEC-ASL-1094, Vol. I; AD-631656) CFSTI: HC $10.60/MF $0.75

The primary objective of this study was to further demonstrate the applicability of applied load ratios to full-size aircraft components for simulating elevated temperature static tests at room temperature. Plane-strain cross-section procedures are used for analytical definition of the applied load ratios in a similar manner to the original feasibility study performed with the use of simplified box beams. This study includes the experimental and analytical investigation of strength and deformation characteristics of several identical horizontal stabilizers in a room temperature environment as well as in various symmetrical and unsymmetrical steady-state elevated temperature environments. This study also includes the theoretical investigation into the feasibility of using applied load ratios when the mode of failure involves mechanical fasteners in critical splice joint areas. The main conclusion of this study is that although the analytical procedures for the two distinctly different modes of failure are somewhat different, deflection is the major parameter essential to simulation-factor or applied-load-ratio definition. Author (TAB)

N66-27719# Michigan Univ., Ann Arbor.
TRANSIENT LOADING TESTS ON A RIGID CIRCULAR FOOTING Final Report
Vincent P. Drnevich, John R. Hall, Jr. and Frank E. Richart, Jr. Feb. 1966 71 p refs
(Contract DA-22-079-ENG-340)
(Rept.-3-148; AD-631369) CFSTI: HC $7.60/MF $0.75

This report presents data obtained from transient loading tests on a one-foot-diameter relatively rigid footing resting on the surface of a bed of sand. Results are presented showing the load applied to the footing and the resulting acceleration of the footing. Two types of load pulses were applied to the footing, having rise times of approximately 4 msec and 20 msec. The magnitude of the loads was such that the response of the footing was essentially elastic. This allowed a direct comparison to the theory for the response of a footing resting on an elastic half space acted upon by a transient load. The mass of the footing was varied to produce different footing response characteristics. The results of the tests show that the theory leads to a reasonable prediction of the response of the footing to transient loads. The critical part of the analysis is the procedure for evaluating the effective shear modulus of the soil under the footing for the range of deformations to be encountered. A brief description of the application of the phase plane method of analysis to the footings subjected to transient loads is given. This is shown to be applicable to footings subjected to loads causing permanent deformation as well as elastic deformations. Author (TAB)

N66-27740*# Aerojet-General Corp., Azusa, Calif. Von Karman Center.
PARAMETRIC STUDY OF GLASS-FILAMENT-REINFORCED METAL PRESSURE VESSELS
E. F. Morris, F. J. Darms, R. E. Landes, and J. W. Campbell Apr. 1966 401 p refs /its Aerojet 3184
(Contract NAS3-6292)
(NASA-CR-54855) CFSTI: HC $7.01/MF $2.00 CSCL 20K

Advantages of and design requirements for a load-bearing metal shell with an overwrapped glass-filament shell for high-pressure-fluid storage at +75 to −423° F were investigated. The work covered characterization of metal-shell materials, definition of design-allowable strengths for S-HTS glass-filament-wound composites, analytical procedures for design and evaluation of glass-fiber-reinforced metal tanks, parametric study, and comparative rating. Proper design permits (1) utilization of the maximum load-bearing capabilities of both shells, and (2) operating pressures from 1000 to 4000 psi and above with significantly higher performance than the best cylindrical and spherical homogeneous metal tanks. Author

N66-27850# David Taylor Model Basin, Washington, D. C. Acoustics and Vibration Lab.
THE SIGNIFICANCE OF SHELL-LIKE VIBRATION OF NS SAVANNAH AT LOW FREQUENCIES
John G. Viner Mar. 1966 21 p refs
(DTMB-2152; AD-631148) CFSTI: HC $2.60/MF $0.50

The report examines the significance of shell-like behavior of NS Savannah at low frequencies as measured during underway vibration trials and as estimated by an analog study. In the vicinity of Bulkhead 80, out-of-phase motions were measured which cannot be predicted in any nonuniform bar approach to the analysis of a ship hull, but which might be predicted by treating the hull as a shell. However, examination of the maximum vertical vibration levels at filtered frequencies at this bulkhead showed that these motions were not significant. Vibration levels at blade frequencies indicated the presence of natural frequencies in which the largest amplitude occurred in the vertical direction and in which relatively large athwartship motion occurred, and vice versa. The significant frequencies obtained from vertically oriented transducers at Bulkhead 80 below 9 cps corresponded to hull flexural frequencies. The underway vibration survey gave no indication that shell-like behavior of Savannah is of any engineering significance for mechanical suitability, ship habitability, and operability. Author (TAB)

N66-27862# Newmark, Hansen and Associates, Urbana, Ill.
FEASIBILITY OF MODELING CAVITY BEHAVIOR IN JOINED ROCK MASSES Final Report
Vicksburg, Miss., Army Eng. Waterways Expt. Sta., Nov. 1965 141 p refs
(Contract DA-22-079-ENG-225)
(AEWES-CR-1-135; AD-631028) CFSTI: HC $14.60/MF $1.00

The general scaling relationships for nuclear effects are reviewed. For a spherically symmetric wave which approximates a measured velocity pulse at a given radius, calculations are made to compare the effects at other radii with the measured values. A discussion of the general modeling theory is followed by a discussion of the feasibility of modeling large openings in jointed media both in the laboratory and in the field. It is concluded that model tests in the field are preferred, though certain types of studies in the laboratory will be meaningful if accompanied by field studies. Application of the Hard Hat data to the design of larger openings is discussed. The destressed zone around openings in rock is described and the effect of certain parameters is studied. Consideration is given to the mechanism of rock failure at the cavity walls. The feasibility of studying free field stress wave propagation and structural interaction by using lumped parameter systems is considered. Two types of lumped parameter models now in use are described and extensions of recent work are suggested. Further work is recommended which involves field, laboratory, and theoretical studies. Author (TAB)

N66-27864# Army Foreign Science and Technology Center, Washington, D. C.
CALCULATION OF THIN-WALLED AIRCRAFT FUSELAGE-TYPE SECTIONS WITH OPENING
A. F. Kuchinskiy Mar. 1966 20 p refs Transl. into ENGLISH from Tr. Kazansk. Aviats. Inst. (Kazan), v. 77, 1963 p 35-48 (FSTC-HT-23-66-66; TT-66-60964; AD-630860) CFSTI: HC $1.60/MF $0.50

In the article, a method for calculating the concentration and redistribution of stresses in the area of a rectangular opening in a close-ribbed, cylindrical, thin-walled structure like an aircraft fuselage is presented. It is found that the elasticity of the fuselage sectors on either side of the sector with the opening, as well as the length of the opening, have essential influence on the concentration of stress around the opening. Author (TAB)

N66-27878# Brown Univ., Providence, R. I. Div. of Applied Mathematics.
ACCELERATION WAVES IN NONLINEAR MATERIALS
Bernard D Coleman (Mellon Inst.) and Morton E. Gurtin Dec. 1965 22 p refs
(Contract Nonr-562(40))
(TR-4; AD-631419) CFSTI: HC $1.00/MF $0.50

The paper presents a unified discussion of certain recent results concerning the propagation of one-dimensional acceleration waves in nonlinear elastic-materials, linearly viscoelastic materials, and general nonlinear materials with instantaneous elasticity and fading memory. Author (TAB)

N66-27870# Catholic Univ. of America, Washington, D. C.
IMPULSIVELY LOADED STRAIN-RATE-SENSITIVE PLATES
Nicholas Perrone May 1966 27 p refs
(Grant NSF GK-782)
(Rept.-1)

The response of an impulsively loaded isotropically rate-sensitive annular plate is calculated via "exact" and approximate viewpoints. For a typical example numerical results differed by about 3%. The essence of the approximate approach, which represents a natural extension of a previous one dimensional analysis, is that the initial stress profile remains substantially constant during the dominant portion of plastic flow. Author

N66-28008*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF FACE-SHEET STIFFNESS ON BUCKLING OF CYLINDRICAL SHELLS OF SANDWICH CONSTRUCTION
Robert E. Fulton and Nancy P. Sykes Washington, NASA, Jun. 1966 14 p refs
(NASA-TN-D-3454) CFSTI: HC $1.00/MF $0.50 CSCL 20K

Results are presented for the effect of flexural stiffness of face sheets on the buckling of elastic cylindrical shells of sandwich construction subjected to axial and lateral loading. This study shows that when the core is very weak in shear the flexural stiffness of the face sheets can significantly increase the buckling load. This increase is shown to be much larger for axially loaded shells than for laterally loaded ones. Graphical results are based on a linear buckling theory for sandwich shells of the Donnell type, which takes into account the asymmetry of the sandwich faces. Author

N66-28010*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
DIMPLE, SPALL, AND PERFORATION CHARACTERISTICS IN ALUMINUM, COLUMBIUM, AND STEEL PLATES UNDER HYPERVELOCITY IMPACT
Nestor Clough, A. R. Mc Millan (Gen. Motors Corp., Santa Barbara, Calif., and Seymour Lieblein Washington, NASA, Jun. 1966 21 p refs
(NASA-TN-D-3468) CFSTI: HC $1.00/MF $0.50 CSCL 20K

An experimental research program designed to determine the critical damage modes that might be inflicted on various materials by the impact of a high-velocity projectile was conducted. Spherical pyrex projectiles of nominally 2.38- and 3.18-millimeter diameters were accelerated to velocities of approximately 7.6 kilometers per second and impacted against flat-plate targets at room temperature in an evacuated impact chamber. Target thickness at incipient perforation, rear-surface dimple, and spall were determined for plates of AISI 316 stainless steel, 2024-T6 aluminum, and columbium-1 percent zirconium. The results indicated that the thickness at the onset of each of these damage modes varied significantly with each material. Columbium-1 percent zirconium showed thicknesses at incipient dimple and spall substantially greater than those for aluminum and stainless steel. The materials coefficient used to correlate crater depth with the modulus of elasticity of the material was also determined. A wide variation in the value of the materials coefficient was found for the three materials impacted. Author

N66-28012*# IIT Research Inst., Chicago, Ill.
STUDIES IN PRESTRESSED AND SEGMENTED BRITTLE STRUCTURES
Ralph L. Barnett and Paul C. Hermann Washington, NASA, Jun. 1966 137 p refs
(Contract NASr-65(04))
(NASA-CR-506) CFSTI: HC $4.00/MF $1.00 CSCL 20K

A nonlinear theory describing the response of rectangular prestressed segmented beams is verified experimentally. The applicability of the theory is extended to beam-columns and

to I-beams with multiple tendons. The methods of limit analysis are used to predict the ultimate load carrying capacity of prestressed and segmented beams and plates. A statistical hypothesis is developed and verified for scaling the behavior of different height nonflat segmented columns. Finally, the feasibility of prestressing cylindrical and ogive shells is investigated and evidence is obtained which demonstates the practicality of overwinding as a prestressing technique.
Author

N66-28019*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CURRENT STATUS OF PLANE CRACK TOUGHNESS TESTING
William F. Brown, Jr. and John E. Srawley Washington, NASA, 1966 138 p refs Presented at the Am. Soc. for Testing and Mater., Atlantic City, 29 Jun. 1966
(NASA-TM-X-52209) CFSTI: HC $4.00/MF $1.00 CSCL 20K

This report deals with the design and testing of crack-notched specimens for determining the resistance of materials to unstable opening mode crack extension under plane strain conditions. The fundamentals of specimen design and testing, specimen size requirements, practical specimen types, instrumentation, criteria for the analysis of load displacement records, and specimen preparation and testing are discussed.
R.N.A.

N66-28066# Lockheed Missiles and Space Co., Sunnyvale, Calif.
TWO CYLINDRICAL SHELLS IN A COMPRESSIBLE FLUID FLOW
V. N. Buivol and A. N. Guz' [1966] 9 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Uk. RSR (Kiev), no. 4, 1966 p 437–440

The dynamic phenomena occurring in two identical shallow, elastic cylindrical shells, placed parallel to one another, in the potential flow of an inviscid compressible fluid were investigated. It was assumed that the shells are thin and infinite in length, and that the velocity of the unperturbed flow is directed along the shell generator.
D.T.

N66-28081# Illinois Univ., Urbana. Graduate Coll.
A GENERAL TREATMENT OF THE TRANSVERSE VIBRATION OF TAPERED BEAMS
Han-chung Wang (Ph.D. Thesis) [1966] 98 p refs

The general solutions for mode functions, natural frequencies and node locations for transverse vibration of a tapered beam were obtained analytically. The cross-sectional area and area moment of inertia vary along the beam according to two arbitrary powers of the longitudinal coordinate. The method of Frobenius was applied to obtain the series solutions of the mode functions for the beams with any possible combinations of these two arbitrary constants. The coefficients of the series were generated in terms of these two constants. The frequency equations for complete tapered beams were obtained as the solutions of fifth or sixth order differential equations. These equations were derived by combining the differential equations of the mode functions and the differential equations for the end conditions. For truncated beams, the exact solutions for the frequencies were obtained by solving a determinant equation which is derived from the mode functions with appropriate end conditions. Upper bound and lower bound approximations for calculating the fundamental frequencies were also introduced and compared with the exact results. The orthogonality properties for mode functions which lead to the analysis of the transient vibrational response of beams were formulated.
Author

N66-28120# Lockheed Missiles and Space Co., Sunnyvale, Calif.
ON THE STABILITY OF MULTILAYER PLATES
L. P. Pomazi [1965] 10 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Mashinostr. (Moscow), no. 2, 1966 p 29–34

Some problems on the stability of elastic plates consisting of a large number of alternating soft and hard layers are considered. The equations to determine the critical loadings are derived taking account of the transverse strains of the soft layers. Results are presented of their numerical solution on the Setun digital computer. The dependence of the critical forces on the plate parameters under multilateral compression is investigated. Isolated from among the solution of the problem is a class of buckling modes, weakly or strongly dependent on the boundary conditions on the slab surfaces; the concept of local and total buckling is given.
Author

N66-28121# Lockheed Missiles and Space Co., Sunnyvale, Calif.
MODERN CONCEPTION OF THE ORIGIN OF CRACKS
B. I. Smirnov and V. D. Iaroshevich [1966] 16 p refs Transl. into ENGLISH from Sb. Fiz. Pr. Priroda Khrupk. Razrush. Metallov (Kiev), 1965 p 6–21

Previous investigations on crack propagation are reviewed in an attempt to present a modern conception of the origin of cracks. Most investigators consider that the generation of rupture foci in the crystal lattice occurs because of inhomogeneous plastic deformation. The contributing factors are localization of the deformation and blocking of the slip in the surrounding volume. Recently obtained data show that the question of the role of plastic deformation in rupture is essential even for such ideally brittle materials as germanium, silicon, and glass. Attempts to exclude microplasticity in rupture lead to the existence of large compact groups of dislocations in the original crystals. Several dislocation mechanisms of crack formation have been proposed where the unfinished shear mechanism has been worked out in detail. In many cases, pictures of crack origination have been obtained which are comparable with the dislocation schemes. Quantitative estimates of crack generation conditions have also appeared. However, work with these estimates is slight and interaction between the dislocations and the crack has not been considered, nor has the role of time and temperature in crack generation been examined completely.
R.N.A.

N66-28125# Lockheed Missiles and Space Co., Sunnyvale, Calif.
BENDING FLUTTER OF ROTATING ELONGATED BODIES
P. I. Zheludev [1966] 11 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Mekhan. Tverd. Tela, no. 2, 1965 p 160–165

The influence of longitudinal acceleration and angular velocity around the longitudinal axis on the elastic bending vibrations of an elongated body of revolution in a supersonic flow is considered. The aerodynamic operator in the system of differential equations of the vibrations of a body, considered as an elastic beam of variable cross-section, is taken from the solution of slender body theory with terms dependent on the

circulation velocity added. The equations are solved approximately, by the Bubnov-Galerkin method. An algebraic frequency equation with complex coefficients is obtained. An example of computing the critical flutter velocities corresponding to the first vibrations modes for a thin-walled conical beam in the presence of longitudinal acceleration and angular velocity is presented. Author

N66-28220# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
METHOD FOR THE DETERMINATION OF THE CONSTANTS OF INERTIA BY A GROUND VIBRATION TEST [METHODE DE DETERMINATION DES CONSTANTES D'INERTIE A L'AIDE D'UN ESSAI DE VIBRATION AU SOL]
Robert Kappus 1966 27 p refs In FRENCH; ENGLISH summary
(TN-96) CFSTI: HC $2.00/MF $0.50

A ground vibration test, based upon the principle of generalized masses, is proposed as a method of experimentally determining the moments of inertia of airplanes, missiles, etc. In this case, it is pointed out, it is not necessary to materialize the rotation axes of the various modes of freedom. Instead, measurements are made of the different generalized masses, i.e., six when the structure shows rigid body motions. Thus, the generalized masses, frequencies, and corresponding modal shapes are sufficient to determine the whole set of inertia constants. Further, it is noted, if modal deformations occur, the method is still applicable, but complementary mode measurements must be taken. D.T.

N66-28247# Southwest Research Inst., San Antonio, Tex.
INVESTIGATION OF STIFFENED STEEL PLATES Final Report
Thein Wah 9 Apr. 1966 186 p
(Contract NObs-92130)
(AD-631632) CFSTI: HC $5.00/MF $1.00

The report covers the results of uniform pressure tests on six steel plates stiffened by beams. The stiffened plates were loaded in steps into the plastic range. Simple formulas are devised to describe the behavior of the system. A detailed study of the strain and stress distributions obtained experimentally resulted in the following major conclusions. By purely theoretical analysis, it is not possible to obtain a detailed picture of the stress distribution in the stiffeners and the plate. A good estimate of the collapse pressure and deflections of the stiffeners may still be obtained by using equations. The stiffened plate of the proportions tested behaves very much like a fixed-ended beam made up of a stiffener section plus an effective width of plate equal to the spacing between stiffeners, carrying a load per unit length equal to the applied pressure times the effective width, with certain modifications. The weakest part of the plate stiffener combination is the stiffener. The stiffener forms a hinge at the supports and at the centerline while by far the greater portion of the plate itself is within the elastic range. The permanent set or residual deflection is greatly affected by welding distortion and is dependent on the size of plating used. Author (TAB)

N66-28261# ARA, Inc., West Covina, Calif.
RESEARCH ON ENERGY ABSORBING STRUCTURES, PART III Final Report, Feb. 1964-Feb. 1965
Feb. 1965 104 p refs
(Contract AF 49(638)-1144)
(AFOSR-65-0420, Pt. III; AD-616683) CFSTI: HC $4.00/MF $0.75

The report includes three somewhat different studies related to expandable and energy-absorbing structures for aerospace application. The first study is a very-large-deflection analysis of corrugated thin-shell structures employing the principle of minimum complementary energy in conjunction with a variational technique. A second area of study is an investigation of structural damping from hysteresis effects in metals associated with large inelastic deformations. Finally, a novel concept is introduced for a flexible metallic seal, and a theoretical and experimental study is described which demonstrates the feasibility of the concept as applied to a fuel expulsion tank. Author (TAB)

N66-28276# National Aero- and Astronautical Research Inst., Amsterdam (Netherlands).
STRAIN MEASUREMENTS ON EIGHT FULL-SCALE WING CENTER SECTIONS Scientific Report No. 3
P. J. Sevenhuysen, A. Nederveen, and J. Schijve 20 Dec. 1963 49 p refs
(Contract AF 61(052)-439)
(NLR-SR-S.610; AD-631349) CFSTI: HC $2.00/MF $0.50

For an investigation on the equivalence of random and programmed fatigue loads eight full-scale wing center sections were tested. Each fatigue test was preceded by a static test to check the similarity of the stress distribution in all tension skins. In the report the results of these static tests are presented and an analysis of the trends observed is given. The maximum load in the static test was only slightly beyond the mean load of the fatigue tests. The following observations were made: (a) The strain measurements made on port and starboard of the tension skin are in good agreement. (b) The same applies to the strain measurements made on all eight tension skins at the same location. (c) At the same location on different tension skins the average value of the standard deviation was 2%. The scatter is mainly due to the measurement techniques and not to differences between the tension skins. (d) Secondary bending, although small, increased somewhat the scatter of the results. (e) The effect of fatigue loading on the output of the strain gages was very small, despite the high fatigue loading which included failure of many gages. Author (TAB)

N66-28289# General Dynamics Corp., Groton, Conn. Research and Development Dept.
TRANSDUCER SHOCK STUDY
A. D. Carlson and R. J. Mc Grattan 31 Oct. 1965 69 p refs
(Contract N70024-1273)
(U411-65-064; AD-631344) CFSTI: HC $3.00/MF $0.75

A sonar transducer was analyzed to determine the stresses induced in the ceramic drive element by an underwater explosion. The explosion forces are considered as a hydraulic shock along the axis of the transducers, and a mechanical shock normal to this axis. The analysis demonstrates that the peak stresses due to these two loadings occur in two distinct time periods. Therefore, the two types of shock motions are essentially independent of each other. The hydraulic shock at a given standoff is more damaging to the ceramic. Analytical and experimental standoffs for failure compare favorably. Author (TAB)

N66-28299# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
FREQUENCIES OF BEAMS ON PARTIAL ELASTIC FOUNDATIONS

Nathan Rubinstein Mar. 1966 53 p refs
(Contract NOw 62-0604-c)
(TG-804; AD-631363) CFSTI: HC $3.00/MF $0.50

Numerical procedures in obtaining upper and lower bounds to eigenvalues of various beam problems are presented. Various numerical problems and their cure when applying the bounding procedures are discussed. Upper bounds are obtained using the well-known Rayleigh–Ritz procedure and lower bounds are obtained using methods developed by Bazley and Fox (AD-608 356; 'Lower bounds to eigenvalues using operator decompositions of the form B*B'. Archive for Rational Mechanics and Analysis, 10:352-60 (1962)). Computational examples are given and tables of upper and lower bounds are displayed. Author (TAB)

N66-26308# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ENGINEERING METHOD OF CALCULATION OF ELASTIC SYSTEMS FOR FREE VIBRATIONS
E. A. Sekhniashvili 18 Jan. 1966 356 p refs Transl. into ENGLISH of the book "Inzhenernyy Metod Rascheta Uprugikh Sistem na Svobodnyye Kolebaniya" Tbilisi, Gos. Izd. "Sabchota Sakartvelo", 1960 p 1–346
(FTD-MT-64-377; TT-66-61114; AD-631654) CFSTI: HC $7.00/MF $1.75

CONTENTS: Free vibrations of systems with a finite number of degrees of freedom; Free vibrations of systems with an infinitely large number of degrees of freedom; Approximate methods of determining frequencies of free vibrations of material systems; Certain concepts from the calculus of variations; Application of Galerkin method to problems of free vibrations of material systems; Construction of the family of approximating (minimizing) functions during solution of problems of free vibrations of material systems; Determining the fundamental frequency of vibration of material bars; Determining higher frequencies of free vibrations of material bars; Determining frequencies of free vibrations of material systems by an expanded conjugate beam method; Determining frequencies of free vibrations of bar trusses; Influence of shearing strain and inertia of rotation of section on magnitude of frequency of free vibrations; and Determining modes of free vibrations of material bar in the general case. TAB

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N66-26888# Joint Publications Research Service, Washington, D. C.
HELIOTECHNOLOGY, NO. 3, 1965
28 Apr. 1966 65 p refs Transl. into ENGLISH from Geliotekhnika (Tashkent), no. 3, 1965 p 1–64
(JPRS-35192; TT-66-31629) CFSTI: $3.00

CONTENTS:

1. EXPERIMENTAL SOLAR ELECTRIC POWER PLANT N. S. Lidorenko, F. Kh. Nabiullin, A. P. Landsman, B. V. Tarnizhevskiy, Ye. M. Gertsik et al p 1–5 refs (See N66-26887 15-03)

2. TESTING SILICON PHOTOBATTERIES IN LARGE LIGHT FLUXES A. Ya. Bashnyak and L. V. Nechayeva p 6–9 refs (See N66-26888 15-03)

3. SOLAR FURNACES WITH INCLINED COLLECTOR AXIS A. Annayev p 10–14 ref (See N66-26889 15-33)

4. GEOMETRY AND OPTICAL CHARACTERISTICS OF A HEXAHEDRAL MIRROR-FILM MEMBRANE G. Ya. Umarov, Yu. A. Solodyanikov, N. V. Kordub, A. A. Alimov, V. S. Zarubin et al p 15–25 refs (See N66-26890 15-23)

5. A STUDY OF OPTICAL AND ENERGY CHARACTERISTICS OF SOLAR RADIATION COLLECTORS FORMED BY INFLATION B. V. Tarnizhevskiy, A. D. Razgovorov, and I. G. Savchenko p 26–29 refs (See N66-26891 15-23)

6. SEVERAL METHODS OF USING SOLAR FURNACES TO STUDY PHYSICAL CHARACTERISTICS OF MATERIALS A. Annayev, V. A. Baum, and Sh. A. Nazarov p 30–36 refs (See N66-26892 15-33)

7. PREPARING ALUMINUM MIRRORS ON ASBESTOS CEMENT BY THE TRANSFER METHOD G. Ya. Umarov, S. N. Vil'kova, Ye. L. Ayzenshtat, I. A. Novikova, and V. M. Sutyagina p 37–43 refs (See N66-26893 15-15)

8. A DEVICE FOR PRODUCING SINUSOIDAL HEAT WAVES IN SOLAR FURNACES Yu. Z. Mavashev p 44–48 refs (See N66-26894 15-33)

9. THE EFFECT OF TRANSPARENT SCREENS OF SYNTHETIC POLYMER FILM ON TEMPERATURE CONDITIONS IN GREENHOUSES P. F. Rzayev p 49–51 refs (See N66-26895 15-33)

10. NEWS IN SOLAR ENGINEERING P 52–53

11. BIBLIOGRAPHY: LITERATURE ON HELIOTECHNOLOGY FROM 1921 TO 1930 Ye. L. Ravich, comp p 54–63 refs

N66-26889# Joint Publications Research Service, Washington, D.C.
SOLAR FURNACES WITH INCLINED COLLECTOR AXIS
A. Annayev *In its* Heliotechnology, No. 3, 1965 26 Apr. 1966 p 10–14 ref (See N66-26887 15-33) CFSTI: $3.00

A solar furnace whose collector axis is inclined toward the north is described. This arrangement allows the height of the collector to be reduced, as well as the distance from the collector to the heliostat, which directs the energy into the furnace. It is pointed out, however, that this arrangement necessitates a larger heliostat, and one that is ellipsoidal in shape rather than spherical. The calculations are presented giving the dimensions of an inclined axis system which has a collector with a diameter of two meters and an angle of inclination β. D.T.

N66-26892# Joint Publications Research Service, Washington, D.C.
SEVERAL METHODS OF USING SOLAR FURNACES TO STUDY PHYSICAL CHARACTERISTICS OF MATERIALS
A. Annayev, V. A. Baum, and Sh. A. Nazarov *In its* Heliotechnology, No. 3, 1965 26 Apr. 1966 p 30–36 refs (See N66-26887 15-33) CFSTI: $3.00

Methods are proposed for investigating the thermal and physical properties of various materials at high temperatures, using a solar furnace. These include techniques for determining the thermal conductivity of a nonmetallic disk, the thermal diffusivity of refractory materials, and the thermal radiation properties of black bodies. It is pointed out that the primary problem in the use of a solar furnace is the inability to achieve a constant temperature throughout a specimen. D.T.

N66-26894# Joint Publications Research Service, Washington, D.C.

A DEVICE FOR PRODUCING SINUSOIDAL HEAT WAVES IN SOLAR FURNACES

Yu. Z. Mavashev *In its* Heliotechnology, No. 3, 1965 26 Apr. 1966 p 44-48 refs (See N66-26887 15-33) CFSTI: $3.00

An apparatus was developed utilizing solar energy to form sinusoidal heat waves for studying the thermal properties of materials at high temperatures, i.e., 3000° to 3500° C, regardless of their conductivity. The heat source is a solar furnace two meters in diameter with a heliostat. A periodically changing thermal flux was easily obtained in the furnace by modulating a screen in the form of a disk placed between the paraboloid and its focus. The axis of the disk coincided with the principal optical axis of the mirror and the plane of the disk was perpendicular to this axis. As the disk was moved back and forth along the axis, the power of the light flux falling on the specimen was varied. D.T.

N66-26895# Joint Publications Research Service, Washington, D.C.

THE EFFECT OF TRANSPARENT SCREENS OF SYNTHETIC POLYMER FILM ON TEMPERATURE CONDITIONS IN GREENHOUSES

P. F. Rzayev *In its* Heliotechnology, No. 3, 1965 26 Apr. 1966 p 49-51 refs (See N66-26887 15-33) CFSTI: $3.00

Transparent thermal insulating panels were constructed for use as greenhouse roofing and siding in order to cut down on fuel costs. The panels were made of polyamide-polyethylene film on glass, screened on the inside by another layer of polyethylene film. Between the glass and the polyethylene film there was an airspace 25 mm thick. Four of these were built, and then tested in small structures over a period of seven days. It was found that with each structure the average internal air temperature was greater than the average external temperature by: (1) 6° to 12°C; (2) 9° C; (3) 2.5° to 4°C; and (4) 10° to 15°C. From these results it was calculated that the decrease in heat loss with the panels would result in a fuel saving of 21.0 metric tons over the length of a growing season in a greenhouse with a stock area of 1000 square meters. D.T.

N66-26906# Joint Publications Research Service, Washington, D.C.

STUDIES IN THE PHYSICS OF COMBUSTION AND EXPLOSION

16 May 1966 107 p refs Transl. into ENGLISH from Fiz. Goreniya i Vzryva (Novosibirsk), no. 3, 1965 p 3-9; 20-40; 45-53; 83-92

(JPRS-35530; TT-66-31966) CFSTI: $3.00

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1. DETERMINATION OF DETONATION PARAMETERS IN CONDENSED EXPLOSIVES V. A. Veretennikov, A. N. Dremin, and K. K. Shvedov p 1-14 refs (See N66-26907 15-33)

2. HYDRODYNAMIC SOLUTIONS FOR ONE-DIMENSIONAL DISTURBANCE OF AN UNSTABLE DETONATION WAVE L. A. Il'kayeva and N. A. Popov p 15-26 refs (See N66-26908 15-33)

3. CONDITIONS FOR IGNITION OF PORE WALLS DURING COMBUSTION OF POROUS EXPLOSIVE CHARGE A. D. Margolin and S. V. Chuyko p 26-39 refs (See N66-26909 15-33)

4. DYNAMIC CONDITIONS OF THERMAL EXPLOSION' III: TEMPERATURE FIELD DURING HEATING AND QUESTIONS OF TRANSITION FROM SPONTANEOUS COMBUSTION TO IGNITION A. G. Strunina, V. T. Gontkovskaya, and A. G. Merzhanov p 40-47 refs (See N66-26910 15-33)

5. INITIATION OF EXPLOSION THROUGH SHOCK. II: CRITICAL EXPLOSION INITIATION ENERGY M. Ya. Vasil'yev p 48-56 refs (See N66-26911 15-33)

6. DETERMINATION OF THE GENERAL FORM OF THE DETONATION RATE AS A FUNCTION OF EXPLOSIVE CHARGE RADIUS G. G. Rempel' p 57-67 refs (See N66-26912 15-33)

7. INTERACTION OF SHOCK WAVE IN A PLASTIC MEDIUM WITH A DISPLACING OBSTRUCTION WITH CONSIDERATION OF INFLUENCE OF FREE SURFACE G. M. Lyakhov, R. A. Osadchenko, and N. I. Polyakova p 68-84 refs (See N66-26913 15-23)

8. INVESTIGATION OF THE REACTION TIME IN THE ELECTROMAGNETIC DETONATION OF LIQUID EXPLOSIVES A. N. Dremin, O. K. Rozanov, and I. G. Kobe p 85-95 refs (See N66-26914 15-33)

N66-26907# Joint Publications Research Service, Washington, D.C.

DETERMINATION OF DETONATION PARAMETERS IN CONDENSED EXPLOSIVES

V. A. Veretennikov, A. N. Dremin, and D. D. Shvedov *In its* Studies of the Phys. of Combust. and Explosion 16 May 1966 p 1-14 refs (See N66-26906 15-33) CFSTI: $3.00

An experimental determination of the detonation rate, mass velocity, and pressure is made in the Chapman-Jouguet layer and the breadth of the chemical reaction zone in trinitrotoluene (TNT) for a varying initial density and over a wide interval of charge diameters. The electromagnetic method was used for determinations in charges with diameters of less than 100 mm, and the displacing metallic foil method was used for larger charge diameters. In most cases, especially when the charge rate diameter was close to critical, simultaneous measurements were made. It is pointed out that reaction time in a high density explosive cannot be accurately measured by the electromagnetic method because the buildup of the leading edge of the mass velocity profile oscillogram in the detonation wave is equal to the chemical reaction time. Various curves are included to illustrate the results; and it is shown that a full identity of the parameters and the state of the explosion products in the Chapman-Jouguet layer is obtained under ideal detonation conditions in cases with noticeable differences in finite values for charge diameters. M.W.R.

N66-26908# Joint Publications Research Service, Washington, D.C.

HYDRODYNAMIC SOLUTIONS FOR ONE-DIMENSIONAL DISTURBANCE OF AN UNSTABLE DETONATION WAVE

L. A. Il'kayeva and N. A. Popov *In its* Studies of the Phys. of Combust. and Explosion 16 May 1966 p 15-25 refs (See N66-26906 15-33) CFSTI: $3.00

The chemical reaction zone is examined as idealized for the case of an unstable plane detonation wave with one-dimensional disturbances. It is assumed that the state of the material in the chemical region does not change until the temperature-dependent induction period terminates, after which there is a drastic change because of the speed with which the reaction energy is liberated. In such an idealization, the development rate of small disturbances in the combustion

front is infinite, and instability is realized by finite disturbances. The combustion front is considered to be a hydrodynamic discontinuity, and hydrodynamic solutions are examined for these disturbances. Illustrations are included for the positive disturbance in normal and overcompressed detonation waves; as well as for negative disturbance in a depression-type wave. Hydrodynamic calculations are given for both a stable and an unstable detonation wave. M.W.R.

N66-26909# Joint Publications Research Service, Washington, D. C.

CONDITIONS FOR IGNITION OF PORE WALLS DURING COMBUSTION OF POROUS EXPLOSIVE CHARGE

A. D. Margolin and S. V. Chuyko *In its* Studies of the Phys. of Combust. and Explosion 16 May 1966 p 26–39 refs (See N66-26906 15-33) CFSTI: $3.00

Simplified models of the heat effect of hot gases on pore walls are examined in an effort to explain the disruption in the normal combustion of porous explosive charges. The heating and ignition of pore walls in a burning explosive charge by inflowing hot gases are discussed, as is the ignition of walls because of the combustion propagation of the hot gases. Thermal explosion of the gases, heatup of gases due to their compression, and influence of pore imperfections are considered. Peculiarities in powdered explosive charges are mentioned. M.W.R.

N66-26910# Joint Publications Research Service, Washington, D. C.

DYNAMIC CONDITIONS OF THERMAL EXPLOSION. III: TEMPERATURE FIELD DURING HEATING AND QUESTIONS OF TRANSITION FROM SPONTANEOUS COMBUSTION TO IGNITION

A. G. Strunina, V. T. Gontkovskaya, and A. G. Merzhanov *In its* Studies of the Phys. of Combust. and Explosion 16 May 1966 p 40–47 refs (See N66-26906 15-33) CFSTI: $3.00

A numerical solution is presented for the equations for thermal explosion during heatup with changes in ambient temperature occurring at a constant rate. Irregularities in ignition are found to exist under dynamic heating conditions; and four regimes are distinguished for the flow: (1) no ignition, (2) spontaneous combustion region, (3) transition region to ignition, and (4) threshold ignition region. The analysis was made for a first order reaction in which there is transition from spontaneous combustion to ignition under dynamic conditions. M.W.R.

N66-26911# Joint Publications Research Service, Washington, D. C.

INITIATION OF EXPLOSION THROUGH SHOCK. II: CRITICAL EXPLOSION INITIATION ENERGY

M. Ya. Vasil'yev *In its* Studies of the Phys. of Combust. and Explosion 16 May 1966 p 48–56 refs (See N66-26906 15-33) CFSTI: $3.00

A time lens as well as the ruputre characteristics of the barrier holding the broken-off plate were used to determine if the impact of the plate caused an explosion in an explosive charge. Accuracy of the determination is characterized by the deviation of the plate's velocity from the critical value by ±0.5%; and raising the critical velocity by 0.5% produces 100% explosions, while a 5% reduction results in no explosions. Reproducibility of the experiments, influence of velocity, and absence of any effects from the mass of the plate are shown. Computations were made of the quantity of energy entering the explosive through the plate's shock as well as the velocity of the shock wave in the explosive charge. Dynamic compressibility results are given for the determination of critical velocity of the plate initiating explosion in trotyl of varying density and other explosives. M.W.R.

N66-26912# Joint Publications Research Service, Washington, D. C.

DETERMINATION OF THE GENERAL FORM OF THE DETONATION RATE AS A FUNCTION OF EXPLOSIVE CHARGE RADIUS

G. G. Rempel' *In its* Studies of the Phys. of Combust. and Explosion 16 May 1966 p 57–67 refs (See N66-26906 15-33) CFSTI: $3.00

An empirical relationship is obtained to express detonation rate as a function of explosive charge radius in various explosives. Graphs are plotted for results with trotyl and amatol; and results are tabulated for various forms of these and for other explosives. The equation presented permits the computation of the detonation constant for any explosive charge with finite dimensions. M.W.R.

N66-26914# Joint Publications Research Service, Washington, D. C.

INVESTIGATION OF THE REACTION TIME IN THE ELECTROMAGNETIC DETONATION OF LIQUID EXPLOSIVES

A. N. Dremin, O. K. Rozanov, and I. G. Kobs *In its* Studies of the Phys. of Combust. and Explosion 16 May 1966 p 85–95 refs (See N66-26906 15-33) CFSTI: $3.00

Interaction of the detonation wave with various obstructions is investigated for liquid explosives, and a direct measurement is made of the mass velocity profile of the wave by the electromagnetic method. Photographs of detonation propagation along the explosive charge are shown for aluminum foils and mica. Experimentally calculated mass velocities were found to correlate with theoretical computations. It was not possible to directly measure total reaction time in pure nitromethane, and the dependence of the detonation upon reaction time was not determined for any of the liquid explosives investigated. M.W.R.

N66-26915# Michigan Univ., Ann Arbor. Lab. for Fluid Flow and Heat Transfer Phenomena.

NATURAL CONVECTION IN A RECTANGULAR CAVITY WITH INTERNAL HEAT GENERATION

Willy Smith and Frederick G. Hammitt Apr. 1965 41 p refs Sponsored in part by NSF

(Rept.-05031-2-I)

Consideration is given to a closed rectangular cavity with internal heat generation which is cooled along a pair of vertical side walls and which simulates the channels in an internally-cooled homogeneous nuclear reactor. An experiment is conducted with water, but the theoretical analysis considers fluids of arbitrary Prandtl number; and good agreement is found between theoretical and experimental results. Extensive computer calculations verified a formal relationship among the non-dimensional parameters that follows the one-fourth power law typical of natural convection. Temperature mapping indicates that a maximum in the temperature profile exists and that the velocity profile also has a positive maximum. Flow is essentially laminar for values up to $a/bRa = 4.0 \times 10^8$, although for values larger than 2.9×10^8 there is some slow eddying in the upper part of the central core and in the lower part of the boundary layer. M.W.R.

N66-27024# Sandia Corp., Albuquerque, N. Mex.
THE COMBUSTION AND EXPLOSION OF ZIRCONIUM DROPLETS IGNITED BY FLASH HEATING
L. S. Nelson Jan. 1966 58 p refs
(Contract AT(29-1)-789)
(SC-RR-65-569) CFSTI: HC $3.00/MF $0.75

The method of flash heating was applied to single zirconium droplets (diameters between 49 and 525 microns) in air, oxygen, and various mixtures of oxygen with argon and nitrogen. The brightly burning droplets were studied during free fall by still and high-speed photography, transmission grating spectroscopy, and pyrometry. Droplets were also quenched in liquid argon at various stages in the combustion and studied by photomicrography, ultramicro weighings, and X-ray diffraction. Durations of incandescence in liquid argon were also measured. The chemical and physical changes of the droplets were determined at various stages in the combustions. Particular emphasis was placed on understanding the curious explosions of some droplets a few hundred milliseconds after ignition. It was concluded that the overall burning reaction is $Zr\ (liquid)+O_2(gas)\rightarrow ZrO_2\ (liquid)$. However, if nitrogen is present in the oxidizer (as in air or other oxygen-nitrogen mixtures) or in the metal (as an impurity or intentionally alloyed), the reaction has intermediate stages. An analogous set of reactions may hold for carbonaceous contaminants in the combustion, where CO instead of N_2 is the driving gas. Explosions occur also with hydrogen, but only as a result of thermal overpressure in the metal as it ignites. No appreciable oxidation is necessary as in the nitrogen situation. The experiments described rule out previously proposed mechanisms for explosion of zirconium droplets—those that rely solely upon the interaction of condensed phases or upon boiling of either the metal or its oxide. Other metallic materials that explode during combustion as droplets are discussed.

Author (NSA)

N66-27043*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF CORNER RADIUS ON STAGNATION-POINT VELOCITY GRADIENTS ON BLUNT AXISYMMETRIC BODIES
Ernest V. Zoby and Edward M. Sullivan Washington, NASA, Mar. 1965 17 p refs
(NASA-TM-X-1067) CFSTI: HC $1.00/MF $0.50 CSCL 01A

Results of an analytical study initiated to determine the effects of corner radius on stagnation-point velocity gradients on blunt bodies at a 0° angle of attack are presented. The blunt bodies investigated included a range of ratios of body radius to nose radius r_B/r_N from 0 (flat-faced cylinder) to 1.0 (hemisphere) and ratios of corner radius to body radius from 0 (sharp corner) to 0.3. The velocity gradients on the blunt bodies were calculated from published experimental pressure distributions with the aid of the thermodynamic properties of equilibrium air and isentropic flow relationships. For a r_B/r_N ratio less than 0.5, increasing the corner radius increases the velocity gradient and thus increases the stagnation-point heating rate. These effects become more pronounced with increasing nose radius. For a r_B/r_N ratio greater than 0.5, the corner radius has a negligible effect on the velocity gradient for the range of corner-radius ratios investigated.

Author

N66-27055*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
STUDY OF AEROTHERMODYNAMIC PHENOMENA ASSOCIATED WITH REENTRY OF MANNED SPACECRAFT
Final Report, Nov. 1964–May 1966
L. F. Hearne, J. H. Chin, and L. W. Woodruff May 1966 572 p refs
(Contract NAS9-3531)
(NASA-CR-65368; Y-78-66-1) CFSTI: HC $8.72/MF $2.75 CSCL 01A

This study was conducted to provide a comprehensive description of the phenomena affecting aerothermal heating of manned reentry vehicles. The phenomena governing the inviscid flow, radiative heat transfer, and convective heat transfer were investigated. The most important phenomena are identified and prediction methods accounting for their effects are formulated after a review of the existing theory and experimental results. Computer programs for calculating the aerothermal environment or for routine heating history computations are presented. Factors affecting heat transfer measurements are delineated. Procedures are presented for a first order estimate of sensor heating effects due to streamwise variations in surface temperature and discontinuities in surface mass injection and wall chemical reactivity. Thermal performance characteristics of capacitance and asymptotic calorimeters are analyzed and theoretical models for characterizing their response under transient nonuniform heating conditions are presented. Automated procedures for data reduction to be obtained in Apollo flight tests are given. R.N.A.

N66-27115# Atomics International, Canoga Park, Calif.
STEADY-STATE SODIUM BOILING AND HYDRODYNAMICS
H. Lurie 15 Jan. 1966 55 p
(Contract AT(11-1)-GEN-8)
(NAA-SR-11588) CFSTI: HC $3.00/MF $0.50

A study of boiling heat transfer characteristics and critical heat flux for sodium in forced convection was performed for inlet velocities between 1.1 and 8.7 ft/sec, pressures of 2 to 8 psia, and average subcoolings to 116°F or qualities up to 14%. A study of two-phase pressure drops and void fractions was also performed for vertical upflow of sodium in an unheated annulus with velocities from 0.5 to 4 ft/sec, pressures of 1.5 to 10 psia, and qualities up to 14%. The data obtained in forced convection boiling show that ordinary convective heat transfer seems to dominate practically up to the critical heat flux, with only a very small range of nucleate boiling heat transfer noticeable. Critical heat fluxes up to 1.6×10^6 Btu/hr-ft^2 were obtained. Under two-phase conditions, the critical heat flux for sodium was found to be a strong function of both pressure and quality; it increased with pressure, and first increased then decreased with increasing quality. The two-phase frictional pressure loss was correlated in terms of the Martinelli parameters. Over the range of variables covered no parametric dependence on flow rates and pressures could be discerned. The void fraction during the two-phase flow was also correlated using the Martinelli parameter and indicates slip ratios considerably higher than, and void fractions lower than, those reported for water at the same value of the Martinelli parameter. Author (NSA)

N66-27135# Atomics International, Canoga Park, Calif.
METHODS FOR PREDICTING AERODYNAMIC HEATING RATES TO HIGH-VELOCITY BODIES IN THE UPPER ATMOSPHERE
R. D. Elliott 15 Jan. 1966 44 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-11704) CFSTI: HC $2.00/MF $0.50

The basic physical phenomena associated with aerodynamic heating are described. The methods currently used at AI for predicting heating rates to bodies moving at high velocities through the earth's atmosphere are summarized. The

methods described provide the principal input data for the analytical studies of SNAP reentry disintegration in the Aerospace Nuclear Safety Program. Author (NSA)

N66-27143# General Electric Co., Schenectady, N. Y.
REFERENCE TABLE: THERMOCOUPLE EMF *VS.* TEMPERATURE FOR TUNGSTEN–3% RHENIUM VS. TUNGSTEN–25% RHENIUM THERMOCOUPLES
F. C. Schoenig and J. A. Kadlecek [1965] 9 p refs
(Contract W-31-109-ENG-52)
(KAPL-M-6498-FS-1) CFSTI: HC $1.00/MF $0.50

A tabulation of thermocouple emf vs temperature is presented for W–3%Re/W-25% Re thermocouples over the range of temperatures from 0 to 2390°C. NSA

N66-27175# Oak Ridge National Lab., Tenn.
DISSIPATION OF HEAT FROM LARGE-SCALE CTR APPARATUS AT ORNL
W. L. Wright *In* Calif. Univ. Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res. [1965] p 177–181 (See N66-27146 15-25) CFSTI: HC $6.00/MF $1.25

Design criteria for the quality of water in a cooling water system that dissipates heat generated in the solenoids of a system that produced magnetic fields for controlled thermonuclear reaction experiments are discussed. The water cooling system consists of: (1) a forced-draft cooling tower, (2) a dual-pressure loop that circulates demineralized water, and (3) filtering equipment that deionizes and deoxygenates the water. Specific electrical resistance, total solid content, and dissolved oxygen content characteristics of the water are particularly discussed. Details are also given for maintaining the quality of water in a closed-loop circulating system by means of diverting a slipstream through a filtering system and mixed-bed, deionizing, deoxygenating units. Flow diagrams and associated instrumentation for the demineralizing sections of the cooling loop are shown. Also described is the partial automation of the cooling water system that tends to operate only that part of the system needed to dissipate the heat load being generated at any particular time. Manpower requirements, operation, maintenance, monitoring, and supervision for the system are outlined. L.S.

N66-27176# California Univ., Livermore. Lawrence Radiation Lab.
TARGETS FOR THE ASTRON 600-MW ELECTRON BEAM
James F. Ryan *In its* Proc. of the 1965 Symp. on Eng. Probl. of Controlled Thermonuclear Res. [1965] p 182–187 refs (See N66-27146 15-25) CFSTI: HC $6.00/MF $1.25

Water-cooled aluminum targets used to locate and measure the 4-MeV, 150-A electron beam are described. Average power of 1200 W and pulse power of 600 MW are handled by a movable tree-slat target 2 in. in diameter. Examples of melting and spalling on targets of aluminum, copper, and tantalum are shown. Author

N66-27194*# National Aeronautics and Space Administration, Washington, D. C.
THE COMBUSTION OF THREE-COMPONENT CONDENSED MIXTURES [GORENIYE TREKHKOMPONENTNYKH KONDENSIROVANNYKH SMESEY]
N. N. Bakhman and Yu. A. Kondrashkov Jun. 1963 13 p refs Transl. into ENGLISH from Zh. Fiz. Khim. (Moscow), v. 37, no. 1, 1963 p 216–219
(NASA-TT-F-8436) CFSTI: HC $1.00/MF $0.50 CSCL 21B

For systems burning in the gas phase, adding large metal particles has no marked effect on the rate of combustion (reduces it slightly). This is because the particles burn too far from the main zone of combustion, while there is only a slight reduction in the temperature of the combustion zone due to preheating and phase transformations of the particles, provided the latter are sufficiently large. As the size of the metal particles decreases, the heat losses due to the initial heating of the particles increases. At the same time there is an increase in the flow of heat from the zone of particle combustion to the main combustion zone. Accordingly, as the particles are reduced in size, the rate of combustion will pass through a minimum and then increase (if the heat of combustion of the metal is sufficiently large). If the percentage of metal added is not too large, so that the stage of particle combustion is not the leading stage, there exists a minimum size of the metal particles, below which the rate of combustion will stop increasing with further pulverizing of the metal. This theory has been partially tested by means of experiments with a mixture of $CKIO_4$, bitumen, and particles of W, Al, Ti, and Zr. Author

N66-27227*# AVCO Corp., Wilmington, Mass. Space Systems Div.
DEVELOPMENT OF PASSIVE TEMPERATURE CONTROL COATINGS FOR USE ON THE APOLLO VEHICLE ABLATIVE THERMAL PROTECTION SYSTEM Final Report
Tibor S. Laszlo, R. E. Gannon, C. T. Hughes, and M. Rand Apr. 1966 128 p refs
(Contract NAS9-3406)
(NASA-CR-65386; AVSSD-0012-66-RR) CFSTI: HC $4.00/MF $1.00 CSCL 20M

This report describes a program to develop a passive temperature control coating system for the Apollo spacecraft to alleviate the high and low temperature extremes of the vehicle during the hot and cold soak portions of the trajectory. The program screening tests, selection criteria, process developments, and simulated environmental tests of both the thermal control coating and rocket exhaust protection system are described. Two systems were developed which met the specified requirements. These are a textured aluminum foil covered with a noncontinuous layer of potassium metasilicate and a textured aluminum foil covered with an openweave fiberglass cloth. R.N.A.

N66-27255# Brookhaven National Lab., Upton, N. Y.
HIGH-TEMPERATURE LIQUID-METAL TECHNOLOGY REVIEW, VOLUME 3, NO. 6, DECEMBER 1965 A Bimonthly Technical Progress Review
Feb. 1966 40 p refs
(Contract AT(30-2)-GEN-16)
(BNL-972(PR-18)) CFSTI: HC $2.00/MF $0.50

Twenty-one reviews of current topical and progress reports on research and development programs concerned with liquid metals are presented. Subjects covered include: physical properties and thermodynamics, fluid dynamics, heat transfer, material development and corrosion, instrumentation, component development, and chemistry and chemical analysis. NSA

N66-27262# Argonne National Lab., Ill.
SELF-SUSTAINED HYDRODYNAMIC OSCILLATIONS IN NATURAL-CIRCULATION TWO-PHASE-FLOW BOILING LOOP

Kamal C. Jain Aug. 1965 122 p refs
(Contract W-31-109-ENG-38)
(ANL-7073) CFSTI: HC $4.00/MF $0.75

The effects of geometry, subcooling, and pressure on the inception and development of oscillatory behavior in a natural-circulation boiling-water loop were studied. The critical power density was determined by an arbitrary criterion, since the steady-oscillation amplitude increases continuously with power. For large oscillations, periodic inlet-flow reversals were found which could be large compared to the steady inlet-flow velocities. These phenomena are emphasized by lower system pressure and small-diameter test section and riser. Other parameters did not affect these phenomena in a distinct fashion. The frequencies of the oscillations varied from 0.24 cps to 0.76 cps and, in general, increased with increasing power, as did the flow amplitudes. Two theoretical models were investigated, one linear and one non-linear. The linear analysis in frequency domain due to Jones showed good ability to predict the oscillation threshold and the frequency associated with the initial oscillations. The predictions of the threshold power were correct within ±5% for over 60%, and within ±10% for over 80%, of the tested cases. The nonlinear model of Jahnberg had to be modified to provide a satisfactory prediction of the steady inlet-flow velocities. However, this modification and the original model failed to give reasonable predictions of the oscillation thresholds and frequencies. Neither form of the model provided a satisfactory prediction of the amplitudes. It is thought that the one-dimensional formulation fails to take into account vaporization, which acts as a periodic forcing function, of superheated liquid near the leading edge of the two-phase region: The introduction of such a forcing function allows the computation of periodic bounded oscillations similar to those observed experimentally, and also explains qualitatively the observed trends with parameter variation. Author (NSA)

N66-27391# California Univ., Berkeley. Lawrence Radiation Lab.
BEHAVIOR OF DROPLETS EVAPORATING IN HIGH TEMPERATURE CONVECTIVE ENVIRONMENTS
Joannes Baptists Wijffels (M.S. Thesis) Sep. 1965 87 p refs
(Contract W-7405-ENG-48)
(UCRL-16656) CFSTI: HC $3.00/MF $0.75

The behavior of small droplets in a temperature convective environment of their own vapor at low Reynolds numbers was investigated. The behavior of large droplets evaporating in a stagnant environment at quasi steady state is well known. The solution is used as a basis, to which corrections are applied, for the evaporation of very small droplets and for the evaporation in convective flow. An expression was obtained for the drag exerted on the droplet by the convective environment. Approximate analytic and numerical solutions were obtained for the problem although the presence of the convective flow field does not alter the total evaporation rate, the drag exerted and rapidly evaporating drop is lowered appreciably, compared to the case of Stokes flow. Author (NSA)

N66-27413# Pennsylvania State Univ., University Park. Dept. of Fuel Science.
COMBUSTION BEHAVIOR OF THERMOPLASTIC POLYMER SPHERES
R. H. Essenhigh and W. L. Dreier (M.S. Thesis) Mar. 1966 254 p refs
(Contract Nonr-656(29))
(FS66-1; AD-630912) CFSTI: HC $25.00/MF $1.25

The investigation was undertaken to study the combustion behavior of 11 thermoplastic polymer spheres burning in air. They were photographed during combustion so that burning rates could be obtained and compared to calculated values determined through the use of appropriate mass and heat transfer equations. The rates were used as a means of determining whether the polymer sphere combustion system could be compared to the more complex combustion system involved in hybrid rockets that employ polymers as fuels. The polymers appeared to burn in two stages. Polymers with a low carbon content burned almost entirely in a volatile state, characterized by a bright diffusion flame established at some distance from the polymer sphere surface. At volatile burnout, a small amount of residue remained that burned away too rapidly to be measured. The polymers with a high carbon content burned with a quick volatile combustion stage, leaving a carbonaceous residue that burned away slowly with a bright red glow. The volatile burning times, for polymer spheres 0.5 to 1.5 mm in diameter, were between 0.1 and 2.0 seconds while the residue burning time ranged between 1 and 30 seconds. TAB

N66-27421# Ohio State Univ., Columbus. Rocket Research Lab.
DETONABILITY OF COMBUSTIBLE MIXTURES
Loren E. Bollinger Sep. 1965 34 p refs
(Contract AF-AFOSR-203-65)
(AFOSR-66-0342; AD-630641) CFSTI: HC $2.00/MF $0.50

A limited review is given of experimental and theoretical research on the formation of detonation waves in combustible gaseous mixtures. The initiation, propagation, and transition problems were studied in some detail. TAB

N66-27439# Army Foreign Science and Technology Center, Washington, D. C.
HEAT TRANSFER TO THE SURFACE OF GAS TURBINE BLADES
Ye. R. Plotkin and Ye. I. Molchanov Feb. 1966 15 p refs
Transl. into ENGLISH from Teploenerg. (Moscow), no. 11, Nov. 1964 p 72-74
(FSTC-HT-23-33-66; TT-66-60954; AD-630849) CFSTI: HC $1.60/MF $0.50

The article studies heat transfer to the surface of gas turbine blades on the basis of experimental data for a nonstationary blade temperature field obtained by the authors during experimental investigation of various transient regimes of an operating gas turbine engine. According to the authors the literature hitherto contained no data on the coefficients of heat transfer to blades under actual gas-turbine operating conditions. Author (TAB)

N66-27448# California Univ., Berkeley. Lawrence Radiation Lab.
MEASUREMENT OF HEAT RELEASED ON SOLID SURFACES
Rolf H. Muller and Louis B. Nobbe Dec. 1965 38 p refs
(Contract W-7405-ENG-48)
(UCRL-16472) CFSTI: HC $2.00/MF $0.50

The measurement of reaction enthalpies on solid surfaces of simple, well-defined geometry requires a quantitative knowledge of heat dissipation and the measurement of exceedingly small temperature differences. Both of these problems are analyzed theoretically with particular reference to the determination of heats of adsorption and immersion using presently available instrumentation. Author (NSA)

N66-27448# California Univ., Berkeley. Lawrence Radiation Lab.
VAPOR PRESSURE OF LEAD AND ACTIVITY MEASUREMENTS ON LIQUID LEAD-TIN ALLOYS BY THE TORSION EFFUSION METHOD
Donald Thomson Hawkins (M.S. Thesis) Jan. 1966 30 p refs
(Contract W-7405-ENG-48)
(UCRL-16514) CFSTI: HC $2.00/MF $0.50

The vapor pressure of pure lead was measured in temperature range between 950° K and 1105° K. The selected $\Delta H^{0}_{T,298}$=46620±170 cal/gm-atom agrees very well with previous measurements. Vapor pressures of lead over liquid lead–tin alloys were determined over the entire composition range. From these measurements and the Gibbs–Duhem relation, Gibbs energy values for both components were calculated. Correlation with existing heat of formation data allowed determination of entropy values. No surface depletion was found for these liquid alloys. Author (NSA)

N66-27474# Catholic Univ. of America, Washington, D. C. Div. of Nuclear Science and Engineering.
AN INVESTIGATION OF THE EFFECT OF MECHANICALLY INDUCED VIBRATIONS ON HEAT TRANSFER RATES IN A PRESSURIZED WATER SYSTEM
E. D. Jordan and J. Steffens Jul. 1965 105 p refs
(Contract AT(30-1)-2655)
(NYO-2665-1) CFSTI: HC $4.00/MF $0.75

The vibration of solids at high temperature in a high pressure water media was investigated. A high pressure vibrational test section was designed, built and tested as an addition to an existing pressurized water heat transfer loop. An electrodynamic vibration system mechanically vibrated an electrically heated rod which is transferring heat to pressurized water flowing past the rod. A constant experimental geometry was investigated with convective heat transfer rates investigated in the region of heat fluxes from 50,000 to 80,000 Btu/hr/ft^2, flow Reynolds number from 7000 to 8500, and ΔT (difference between average heater temperature and average water temperature) from 90°F to 210°F. Results of the analyses are presented. NSA

N66-27480# Aerojet-General Nucleonics, San Ramon, Calif.
ALKALI METALS EVALUATION PROGRAM Quarterly Progress Report, Jul. 1–Sep. 30, 1965
P. Y. Achener, E. E. Parr, and E. A. Melaika Oct. 1965 23 p refs
(Contract AT(04-3)-368)
(AGN-8166) CFSTI: HC $1.00/MF $0.50

Progress in the measurement of the thermodynamic and transport properties of the alkali metals is reported. NSA

N66-27487*# National Aeronautics and Space Administration, Washington, D. C.
EMISSIVITY OF A PINNACLED SURFACE. INVESTIGATION OF AN EMISSIVE, FIN-TUBE SYSTEM [IZLUCHATEL'NAYA SPOSOBNOST ZUBCHATOY POVERKHNOSTI, ISSLEDOVANIYE IZLUCHATEL'NOY SISTEMY S OREBRENNYMI TRUBKAMI]
Yu. G. Zhulev and Yu. A. Vasanov May 1966 29 p refs
Transl. into ENGLISH from a Russian publ., 1965
(NASA-TT-F-10134) CFSTI: HC $2.00/MF $0.50 CSCL 20M

The emissivity of a pinnacled surface when the surrounding space is a black body with zero temperature is examined. In the general case the effective emissivity of a pinnacled surface is a function of the degree of blackness of the lateral face of the pinnacle ε, the angle at its apex α, and the dimensionless parameter N, which depends on the following quantities: temperature of the pinnacle base, height of the pinnacle, angle at its apex, and thermal conductivity of the pinnacle material. The initial system of equations is solved for several values of ε, α, and N. Emissivity of a system made of coiled tubes, which are located in parallel and have emissive triangular fins, is also examined. The most favorable distribution of the emissive pinnacles along the cooled tube perimeter and methods for optimization are investigated. Author

N66-27502*# National Aeronautics and Space Administration, Washington, D. C.
THERMAL CHARACTERISTICS OF A PEBBLE BED HEATER
Nisiki Hayashi Jun. 1966 29 p refs Transl. into ENGLISH of Natl. Aerospace Lab. (Tokyo), no. 52, 1963 p 1–15
(NASA-TT-F-10188; NAL-TR-52) CFSTI: HC $2.00/MF $0.50 CSCL 20M

The heat transfer between pebbles contained in a circular tube and the fluid moving through it are considered. Neglecting the effect of the heat capacity of the wall, several analyses are made for the following cases: (1) the initial pebble temperature is equal to that of the fluid and is uniform, (2) the thermal capacity per unit volume of fluid is far less than that of the pebbles. Numerical calculations were performed for two pebble-bed heaters by means of an electronic digital computer. Author

N66-27548# Aerojet-General Nucleonics, San Ramon, Calif.
ALKALI METALS EVALUATION PROGRAM Quarterly Progress Report, 1 Jan.–31 Mar. 1965
[1965] 21 p refs
(Contract AT(04-3)-368)
(AGN-8143) CFSTI: HC $1.00/MF $0.50

The status of the boiling heat transfer and fluid flow studies of K, Rb, and Cs is summarized briefly. In the studies of Rb and Cs thermodynamic and transport properties, some experimental PVT data are given for Cs. Preliminary tests of the oscillating-cup viscosity apparatus are described. Development of equipment for thermal conductivity and viscosity measurements on vapors is summarized. The equations which fit the experimental data on the latent heat of vaporization and vapor pressure of K, are given. NSA

N66-27572# Navy Mine Defense Lab., Panama City, Fla.
AN INVESTIGATION OF THERMAL INSULATING MATERIALS FOR UNDERSEA HABITATS Interim Report, 1 Jul.–15 Dec. 1965
Lawrence B. Taylor Apr. 1966 20 p refs
(I-98; AD-630936) CFSTI: HC $1.00/MF $0.50

Details and results of a literature search and study of thermal insulating materials for use at elevated pressures in atmospheres suitable for breathing are presented herein. Sufficient theory and data were found to permit determination of heat loss data of some insulating materials, assuming all the gas within the insulation was replaced by the breathing gas mixture. The accuracy of the theoretical values, the degree to which the gas mixture permeates the insulation, and the significance of the gas pressure in the permeation process remain to be determined experimentally. Author (TAB

N66-27574# Aeronutronic, Newport Beach, Calif. Applied Research Labs.
THERMODYNAMIC PROPERTIES OF PROPELLANT COMBUSTION PRODUCTS Second Quarterly Letter Report, 1 Sep.–31 Dec. 1965
N. D. Potter 31 Dec. 1965 8 p refs
(Contract AF 49(638)-1577; ARPA Order 317)
(QLR-66-3; AFOSR-66-0354; AD-630634) CFSTI: HC $1.00/MF $0.50

The objective of this program is to provide thermodynamic data for species which are potentially important combustion products of advanced chemical rockets and for related species. Enthalpy and entropy data are obtained from equilibrium measurements made by torsion-free evaporation and torsion-effusion techniques and by high temperature mass spectrometry. Author (TAB)

N66-27711# Princeton Univ., N. J. Dept. of Aeronautical Engineering.
THEORY OF THERMAL CONDUCTANCE IN A COLLISIONLESS GAS
Yau Wu Jun. 1965 30 p refs
(Contract AF 49(638)-1271; Grant NSF GK-59)
(Rept.-746; AD-631737) CFSTI: HC $2.00/MF $0.50

The theory of thermal conductance in a collisionless gas in an arbitrary closed system has been developed. The pressure, density, temperature and isotropicity (1) in the system are not uniformly distributed in general, but PI/square root of T and n square root of TI are invariants throughout the whole region according to the revised theory of thermal transpiration developed recently by Wu. The thermal conductance has been defined as a matrix in a multi-component system. It is not only linearly dependent on the mean density in the system at a given temperature distribution on the boundary, but also depends on the geometry and the reflection law on the boundary of the system. Several geometries have been considered, such as triangular parallel plates, cubes, polygons, polygonal parallel plates and others. A similarity law has been established showing equivalence among the systems of different geometries. Author (TAB)

N66-27738*# Pratt and Whitney Aircraft, East Hartford, Conn. Space Power Systems.
ANALYTICAL STUDY OF LIQUID METAL CONDENSING INSIDE TUBES
H. R. Kunz Jan. 1965 98 p refs
(Contract NAS3-2335)
(NASA-CR-54362; PWA-2530) CFSTI: HC $3.00/MF $0.75 CSCL 20M

An analysis is presented of annular, two-phase flow inside of circular tubes. This analysis enables an estimation of the liquid film thickness for one or two-component flow and the heat transfer coefficient for condensing flow of a pure fluid. Special consideration is given to condensing liquid metals. The results indicate that if no liquid–vapor interfacial resistance to heat flow is considered, the local values of condensing coefficients for potassium in vertical downflow inside a tube are higher than those calculated using Nusselt's theory for laminar condensing on a vertical surface with no liquid–vapor interfacial shear. Shear stress and heat flux distributions are derived for the liquid film and are combined with empirical expressions for turbulent diffusion coefficients and wall shear stress to enable calculation of the liquid velocity and temperature profiles. The expressions for turbulent diffusion coefficients are obtained from data for fully-developed single-phase pipe flow. The velocity and temperature profiles enable the liquid film thickness and condensing heat transfer coefficients to be determined. Author

N66-27748*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
USE OF THERMAL RERADIATIVE EFFECTS IN SPACECRAFT ATTITUDE CONTROL
Charles A. Peterson (M.S. Thesis) May 1966 60 p ref
(Contract NASr-249)
(NASA-CR-75450; CSR-T-66-3) CFSTI: HC $3.00/MF $0.50 CSCL 20M

A theoretical investigation of the possibility of using the lags in thermal reradiation from a spacecraft's absorbing and emitting surfaces to produce nonconservative torques which dissipate oscillations of a given axis was undertaken. Expressions for the ratio of the transverse reradiative pressure to the direct light pressure were developed for the general case, and for the special cases of infinite conductivity, tangential conductivity, and the semi-infinite solid. The effects of reradiative forces on steady precession of a spinning axially symmetric spacecraft were determined. It was concluded: (1) A surface reradiates energy with a time lag with respect to the incident radiation. (2) This time lag can produce a torque partially in phase with angular velocity when the surface is part of a harmonically oscillating system. (3) If a reradiating cylinder is attached in front of the center of mass of a spinning spacecraft, the reradiative torques can align the spacecraft's spin axis with the direction of incident radiation. N.E.N.

N66-27774# Bureau of Mines, Morgantown, W. Va. Coal Research Center.
HIGH-TEMPERATURE ENERGY SYSTEMS Quarterly Progress Report, 1 Aug.–31 Oct. 1965
[1965] 20 p refs
(TID-22394) CFSTI: HC $1.00/MF $0.50

Tests are conducted of a turbocompressor equipped with gas-lubricated bearings. After the diffuser vanes are modified to eliminate compressor surge, tests are begun to define gas flow-pressure rise relationships. Design work is reported on a system for testing the high-temperature turbine. Also, a 15 lb/hr combustor is constructed to evaluate the practicability of fluidized-bed combustion of coal in the primary gas heater. Installation of auxiliary equipment for the combustor is started. A series of tests is completed to determine the film coefficients of heat transfer for suspensions of glass beads in inert gas (88 percent N_2, 12 percent CO_2). The results are inconsistent. Observation of flow through a heat-transfer loop and suspension flow meter simulated in glass reveals the flow to be nonuniform, so both the loop and the meter are modified to eliminate this problem. Author (NSA)

N66-27780# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
THEORETICAL AND EXPERIMENTAL STUDIES OF HEAT TRANSFER AND PRESSURE DROPS ALONG SURFACES FITTED WITH HERRINGBONE FINS. CORRELATION BETWEEN GEOMETRIC AND AEROTHERMAL PARAMETERS [ETUDES THEORIQUE ET EXPERIMENTALE DU TRANSFERT DE CHALEUR ET DES PERTES DE CHARGE DE SURFACES MUNIES D'AILETTES DISPOSEES EN CHEVRON. CORRELATION ENTRE PARAMETRES GEOMETRIQUES ET AEROTHERMIQUES]
Jacques Pelce, Jean Malherbe, and Bernard Pierre Oct. 1965 78 p refs In FRENCH
(CEA-R-2471)

Principal results are given of experimental research which was carried out on the flow of a fluid along a surface fitted with herring-bone fins. Aerothermal tests were effected on a large number of these surfaces whose geometrical parameters were made to vary systematically. In particular, work on a large scale model has made it to analyze the mechanisms of heat transfer and of pressure drops. On this basis a theoretical study has led to the establishment of a correlation between the geometric configuration and the aerothermal performances of these surfaces. Experimental results are in good agreement with the theoretical relationships. An expression was derived applicable to this type of herring-boned surface in a wide zone. Author (NSA)

N66-27826# IIT Research Inst., Chicago, Ill. Technology Center.
PHASE MIGRATION IN A MONOTHERMAL FIELD Annual Report, Dec. 1, 1964–Nov. 30, 1965
Ted A. Erikson 17 Jan. 1966 55 p refs
(Contract AF 49(638)-1121)
(IITRI-C212-10; AFOSR-66-0618; AD-630550) CFSTI: HC $5.60/MF $0.50

The project is concerned with the study of various non-equilibrium processes, specifically those that can be conducted at a steady rate. New experimental data are interpreted on the basis that the properties of terminal stationary states will define the steady flow of heat, mass, and/or volume across a gradient region. A major point of emphasis is that experimental unknowns are lumped into a clearly defined gradient region so that data correlation can be established by properties of well-defined terminal regions. This is different from usual kinetic and heat-transfer approaches in which temperature gradients pose a serious problem when experimental verification is required on a microscopic basis. Surface temperatures in accommodation experiments are a good example. As appendixes there are attached papers on (1) migrational properties for the steady forced vaporization of water, (2) critical pressure index for nitroglycerine sensitivity, and (3) cluster coefficient of water. Author (TAB)

N66-27832# Nuclear Power Field Office, Fort Belvoir, Va.
THERMODYNAMIC PROPERTIES OF MOLECULAR NITROGEN
Franklin D. Jordan Jan. 1966 153 p refs
(Rept.-82; AD-630762) CFSTI: HC $5.00/MF $1.00

The tables include enthalpy, entropy, specific heat at constant pressure, ratio of specific heats, density, speed of sound at very low frequencies, and coefficient of viscosity. The tables of real-gas thermodynamic properties are presented for pressures of .01, 0.1, 0.4, 0.7, 1, 2, 3, ..., 29, 30, 32, ..., 38, 40, 50, 70, and 100 atmospheres. The temperatures involved cover the range of 270 R up to 2160 R. All data are given in dimensionless form. The conversion factors for adaptation of the data to more frequently used units are also included. Author (TAB)

N66-27881# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
PRELIMINARY CALCULATION OF THE ENERGY REQUIREMENT FOR PLACING AN INSTRUMENT PACKAGE UNDER ICE
Chi Tien (Syracuse Univ.) Nov. 1965 27 p refs
(CRREL-RR-146; AD-630982) CFSTI: HC $2.00/MF $0.50

The energy requirement for dispatching an instrument package through ice by thermal heating was estimated, and the feasibility of such an undertaking was determined. Heat fluxes were supplied through the bottom surface of the package as well as through the circumferential surfaces. The ice in contact with the package melts after sufficient heating, and as a consequence the package moves downward. With given assumptions, the energy requirement was estimated first by expressing the rate of melting (downward velocity of the package) in terms of the heat supplied through the bottom surface. With this information, the heat loss through the cylindrical surface was calculated. The sum of these two energy terms gives the total heat required. Author (TAB)

N66-27883# Army Missile Command, Huntsville, Ala.
SEMICONDUCTOR THERMOELECTRIC TRANSISTOR COOLERS
V. K. Garachuk and V. S. Nayer Feb. 1966 11 p refs Transl. into ENGLISH from Priborostroenie (Moscow), v. 1, no. 6, Jan.–Feb. 1965 p 176–181
(RSIC-523; TT-66-61044; AD-631224) CFSTI: HC $1.00/MF $0.50

The design and the result of investigations of semiconductor thermoelectric transistor coolers that operate at high temperatures of the medium are discussed. The thermal energy liberated in powerful germanium transistors operating at temperatures of the surrounding medium of 20° to 40° C is scattered, as a rule, by means of radiators in conditions of forced or natural convection. At 55° to 60° C, such a method of removing heat becomes inefficient because of the low maximum permissible temperature of the p-n junction of the transistor. In these cases, it is necessary to use different methods of cooling. Semiconductor thermoelectric coolers are very promising for cooling radio-electronic apparatus, as they are distinguished by the absence of moving parts or special cooling agents, noiselessness, simplicity of design and operation, convenient and flexible regulation, and easy transition from a cooling regime to a heating regime. Author (TAB)

N66-27929*# Missouri School of Mines and Metallurgy, Rolla.
THE APPLICATION OF SOME THERMODYNAMIC PRINCIPLES TO ESTIMATE THE LIKELIHOOD OF LIFE IN THE SOLAR SYSTEM, PART I Final Report, Feb. 1965–Feb. 1966
James Paul Wesley [1966] 67 p refs
(Grant NGR-26-004-014)
(NASA-CR-75650) CFSTI: HC $3.00/MF $0.75 CSCL 20M

If living objects are defined to be open thermodynamic systems which create and maintain internal states of low entropy by dissipating energy, then only certain environments are favorable to life. One measure of the ability of an environment to support life is its entropy production. A finer measure of the ability of an environment to support life is the efficiency with which the available solar energy can be converted to useful mechanical work. The maximum efficiency with which thermal energy can be converted to useful mechanical power is considered for two idealized heat engines. An upper bound is postulated for the power efficiency of any actual heat engine which is less than the Carnot efficiency. The likelihood of life having entered the solar system from without is considered. It is indicated that sophisticated life forms migh be found close to the sun. Author

N66-27934*# Catholic Univ. of America, Washington, D. C. Dept. of Space Science and Applied Physics.
RADIATIVE TRANSFER FOR PARALLEL STREAMS OF RADIATING GASES

Y. C. Whang Jan. 1966 29 p refs *Its* Rept.-66-001 (Grant NsG-586)
(NASA-CR-75614) CFSTI: HC $2.00/MF $0.50 CSCL 20M

The radiation heat transfer between two parallel streams of absorbing and emitting radiating gases is studied. The problem is described by the Rosseland diffusion approximation together with the radiation slip boundary condition. Considering that the flow is incompressible and inviscid, the exact solution of the problem is obtained. The solution shows a smooth transition regime between the optically thin and the optically thick regions. The thickness of radiation layers is calculated. Author

N66-27966# Hughes Aircraft Co., El Segundo, Calif. Space Systems Div.
DIRECTIONAL EMISSIVITIES FROM A TWO-DIMENSIONAL, ABSORBING-SCATTERING MEDIUM: THE SEMI-INFINITE SLAB
R. P. Bobco Mar. 1966 32 p refs
(SSD-60072R)

A closed-form solution is presented for the directional emissivity at any location on the surface of a semi-infinite slab of an absorbing-scattering medium. The medium is assumed to be a gray, isothermal dispersion which emits, absorbs, and scatters isotropically, and is confined by free boundaries. The solution to this two-dimensional problem is found by the approximate technique based on an iteration of the solution to the diffusion equation. Polar plots of directional emissivity are presented which show the influence of optical thickness, surface location, and scattering strength (albedo). Author

N66-28005# Hawker Siddeley Dynamics, Ltd., Hatfield (England). Aerodynamics Research Lab.
TRANSIENT SURFACE TEMPERATURE MEASUREMENTS ON A SOLID RAPIDLY IMMERSED IN A HOT LIQUID
F. F. Waterhouse Nov. 1965 56 p refs
(ARL-TN-220)

The problem of transient surface temperature measurements on a cold solid rapidly immersed in a hot liquid has been investigated both theoretically and experimentally. This provides a different method of determining $\sqrt{(\rho ck)}_{solid}$ and $1^2/K_1$ the diffusive time of a solid. The possibility of determining the thermal properties of a liquid is also recognised. The technique also serves as a simple means of comparing different methods of transient surface temperature measurement under predominately conductive heat transfer conditions, particularly when the thin film resistance thermometer can be used as a standard for comparison. Comparisons have been made between measurements obtained from a thin film resistance thermometer and a fine wire thermocouple. Author

N66-28016*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RADIATIVE INTERACTIONS BETWEEN ABSORBING-EMITTING AND FLOWING MEDIA WITH INTERNAL ENERGY GENERATION
John R. Howell Washington, NASA, 1966 37 p refs Presented at the Am. Inst. of Aeronautics and Astronautics Fourth Aerospace Sci. Meeting, Los Angeles, 27-29 Jun. 1966
(NASA-TM-X-52202) CFSTI: HC $2.00/MF $0.50 CSCL 20M

An analytical study of the local energy flux and emissive power in two adjacent regions is given. Each region is assigned a radiation absorption coefficient, mass flow rate, heat capacity, and volumetric energy source. The effect of these parameters plus the relative thickness of the regions is examined. The regions are assumed to be infinite, parallel layers of finite thickness in one case, and coaxial cylinders of finite radius in another. The problem of determining the local one-dimensional emissive power and radiant energy flux is solved by using a second-order diffusion solution with emissive power jump boundary conditions where applicable, and in the parameter ranges where such an approach is invalid a Monte Carlo transport analysis is used. The diffusion solution for the cases examined is accurate for optical thickness greater than about unity. The regions are assumed to be gray and have constant properties. A sample problem which demonstrates the use of the derived equations is presented. Author

N66-28069# Lockheed Missiles and Space Co., Sunnyvale, Calif.
TRANSPORT OF RADIANT ENERGY TO SPECTRUM LINES TAKING ACCOUNT OF REABSORPTION
A. T. Onufriev and V. G. Sevast'ianenko 1966 10 p refs Transl. into ENGLISH from Prikl. Mekhan. i Tekhn. Fiz. (Moscow), no. 2, 1966 p 122-125

Based on the diffusion approximation for a planar gas layer, an approximation method is proposed for calculating the characteristics of radiative heat transfer. The method takes into account the occurrence of variable temperature profiles, and large changes in the absorption coefficient with frequency. D.T.

N66-28119# Lockheed Missiles and Space Co., Sunnyvale, Calif.
ON THE EFFECT OF THE RADIATION ENTROPY LAYER
E. A. Romishevskii [1966] 7 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. i Gaza (Moscow), no. 2, 1966 p 182-184

The hypersonic flow around a blunt body in the neighborhood of the stagnation point is considered taking into account volume fluorescence of the air behind the shock. It is shown that a layer with a lowered value of the entropy, due to radiation, and an elevated value of the gas density is formed near the body surface. This radiation entropy layer will extend from the stagnation point downstream along the surface and will affect the convective heat transfer to the body. The structure of this layer is also investigated. Author

N66-28283# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONSTRUCTING I-θ-DIAGRAMS OF COMBUSTION PRODUCTS TAKING INTO ACCOUNT THE DISSOCIATION OF CO_2 AND H_2O
S. A. Tager and A. S. Smirnov 23 Mar. 1966 6 p ref Transl. into ENGLISH from Teploenerg. (Moscow), no. 5, 1965 p 94 (FTD-TT-65-1457/1+2+4; AD-631877) CFSTI: HC $1.10/MF $0.50

The temperatures of combustion products, either directly in the flame or in the intermediate sections of the gas duct, were considered. It is stated that the level of these temperatures substantially exceeds 1500°C and that the dissociation of CO_2 and H_2O must be considered because these reactions take place with the absorption of heat; thus the actual temperatures of the combustion products are lower than the computed calorimetric temperature. An equation is provided for determining the actual temperature of the combustion products. M.S.W.

N66-28264# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
THERMAL PROBLEMS INVOLVED IN SPACE SIMULATION
I. B. Irving and W. J. Billerbeck Aug. 1964 56 p refs
(Contract NOw-62-0604-c)
(TG-595; AD-631825) CFSTI: HC $3.00/MF $0.50

Simulation techniques provide a practical and relatively inexpensive means of obtaining thermal-vacuum characteristics of spacecraft and components. The results of these tests can be evaluated and compared with telemetered measurements of equipment when under actual orbital flight conditions. The ANNA earth satellite (1962 Beta MU 1) cited in this report is a typical example of a spacecraft being subjected to a thorough environmental test program prior to a successful orbital flight. Author (TAB)

N66-28340# Polish Academy of Sciences, Warsaw. Inst. on Nuclear Research.
HEAT TRANSFER ON THE SURFACE OF A SPHERE IN THE FIXED BED [WYMIANA CIEPLA NA POWIERZCHNI KULI W ZLOZU Z KUL]
A. Wierusz (Ph.D. Thesis—Warsaw Tech. Univ.) 1965 138 p refs In POLISH; ENGLISH summary
(INR-658/IX/R) CFSTI: HC $4.00/MF $1.00

The objective of this paper is to describe the local processes in a gas cooled spheres bed. The thermal boundary layer equation valid for a region of spheres surface where the laminar boundary layer exists, is presented. The numerical solution of this equation is possible thanks to experimental measurements of the velocity field around a sphere in the bed. The solution is used for the determination of the local values of Nusselt numbers with the assumption that the heat transfer on the sphere surface can be considered as a conduction through a gas layer. Author

N66-28350# Los Alamos Scientific Lab., N. Mex.
BURN INVESTIGATIONS OF SOME COAXIAL CABLES
F. M. Jackson and R. E. Stapleton 9 Mar. 1966 36 p
(Contract W-7405-ENG-36)
(LA-3451) CFSTI: HC $2.00/MF $0.50

The burning of individual cables and of groups of cables was investigated. The results indicate that a conflagration could occur if a group of coaxial cables were ignited externally. NSA

N66-28369*# National Aeronautics and Space Administration, Washington, D. C.
THE PHENOMENON OF DIMERIZATION OF ALKALI METAL VAPORS AND CALCULATION OF THEIR THERMOPHYSICAL PROPERTIES TO A TEMPERATURE OF 1500°C [YAVLENIYE DIMERIZATSII V PARAKH SHCHELOCHNYKH METALLOV I RASCHET IKH TEPLOFIZICHESKIKH SVOYSTV DO TEMPERATURY 1500°C]
L. D. Volyak May 1966 15 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (USSR), v. 5, no. 3, 1962 p 51–58
(NASA-TT-F-10159) CFSTI: HC $1.00/MF $0.50 CSCL 22M

This article describes the method to be employed in an experimental investigation of the phenomenon of dimerization in alkali metal vapors. It presents the results derived from calculating the thermodynamic functions of sodium vapors up to a temperature of 1500°C. Author

N66-28371*# National Aeronautics and Space Administration, Washington, D. C.
DETERMINATION OF THERMOPHYSICAL CHARACTERISTICS OF MATERIALS AS FUNCTIONS OF TEMPERATURES [OB OPREDELENII TEPLOFIZICHESKIKH KHARATERISTIK MATERIALOV KAK FUNKTSIY TEMPERATURY]
G. A. Surkov May 1966 12 p Transl. into ENGLISH from Dokl. Akad. Nauk Belorussk. SSR (Minsk), v. 10, no. 1, 1966 p 22–25
(NASA-TT-F-10187) CFSTI: HC $1.00/MF $0.50 CSCL 20M

The problem of determining the thermophysical characteristics of a symmetrical body is mathematically formulated, based on the assumption that the density of the body is independent of temperature, and that the thermal conductivity and heat capacity is dependent on the space coordinate and time. It is also assumed that the temperatures are given at certain points; based on these functions, an expression for the temperature field is written. A series of equations are given, from which the precise dependence of the thermal conductivity coefficient on the temperature is obtained. Based on the results, the values of the thermophysical characteristics and of the temperature can be plotted to express their dependence on the temperature. M.G.J.

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N66-28956# Joint Publications Research Service, Washington, D.C.
TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY NO. 314
13 May 1966 70 p refs Transl. into ENGLISH from Chinese
(JPRS-35490; TT-66-31926) CFSTI: $3.00

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N66-26982# Joint Publications Research Service, Washington, D. C.

TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY, NO. 313

5 May 1966 28 p refs Transl. into ENGLISH from Chinese (JPRS-35342; TT-66-31778) CFSTI: $1.00

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N66-27060# General Motors Corp., Indianapolis, Ind. Allison Div.

ALLISON RESEARCH AND ENGINEERING, VOLUME NO. 9, FIRST QUARTER 1966

1966 33 p refs

1. PLASMA DIAGNOSTICS BY MEANS OF LASERS D. J. Rose (MIT) p 1

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3. TRANSMISSION DESIGN FOR AIRCRAFT GAS TURBINES W. L. Mc Intire and C. M. Hawkins p 18–25 (See N66-27062 15-28)

N66-27097# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

AN EVALUATION OF THE USE OF SELECTIVE DISCHARGES FROM LAKE ROOSEVELT TO COOL THE COLUMBIA RIVER

R. T. Jaske Feb. 1966 76 p refs

(Contract AT(45-1)-1830)

(BNWL-208) CFSTI: HC $3.00/MF $0.75

The general operation of the annual Columbia River cooling program for 1963, 64, and 65 is reviewed. The evaluation includes the complete development of the river including Wells Dam and is drawn from the parametric variation of Grand Coulee mixed discharge temperatures. It was concluded that reported effects have been somewhat overstated due to two primary causes: the incorrect assumption that the spill flow is drawn primarily from the upper 5 to 10 ft of the lake; and an unfortunate accumulation of temperature data inaccuracies emanating from the temporary or expedient installation of data input sources. Additional research on the formation and scope of subsurface jet flow in Lake Roosevelt and other large reservoirs in the system is essential to develop an optimal plan which will minimize river temperatures. NSA

N66-27406# Naval Weapons Lab., Dahlgren, Va.

APPLICATION OF NEW TECHNIQUES FOR IDENTIFICATION OF HERO VARIABLES

J. H. Richter, R. W. Carson, and F. Smith Feb. 1966 160 p refs

(W-5/66; AD-630988) CFSTI: HC $15.60/MF $1.00

The purpose of the study, in keeping with the approach of the problem of estimating the degree of hazard of electromagnetic radiation to the weapon system, is the identification of HERO variables. The crew simulation technique was used to reduce the experimental error and to generate the redundant data necessary for a study of the interactions. TAB

N66-27688# Pillsbury Mills, Inc., Minneapolis, Minn. Food Div.

DEVELOPMENT OF FLEXIBLE PACKAGED BREAD-TYPE PRODUCTS INCLUDING BREAD: PHASE I AND II—SINGLE AND MULTIPLE STAGE PROCESSING METHODS

Calvin G. Norris and Sheldon I. Greenberg Feb. 1966 82 p *Its* Tech Rept.-66-30-FD

(Contract DA-19-129-AMC-91(N))

(FD-40; AD-631689) CFSTI: HC $3.00/MF $0.75

A white bread type product packaged in a lightweight, flexible pouch was developed. It is palatable, stable, and commercially sterile. Both single and multiple stage processes were explored. Many formulations were tested with the best products obtained with a synthetic flour formula chemically leavened. A steam water retort was used for cooking and sterilizing the bread product. Sterilization values of F_o=4 were required for sterility. Author (TAB)

N66-27753*# Washington Univ., St. Louis, Mo. Dept. of Economics.

PROGRAM BUDGETING: APPLYING ECONOMIC ANALYSIS TO GOVERNMENT EXPENDITURE DECISIONS

Murray L. Weidenbaum Apr. 1966 29 p refs *Its* Paper No. 6602

(Grant NsG-342)

(NASA-CR-75492) CFSTI: HC $2.00/MF $0.50 CSCL 05C

This paper discusses the new Planning-Programming-Budgeting System (PPBS) of the Federal Government, which represents a major advance in the application of economic analysis to public finance decision making. Antecedent developments in the economic analysis of governmental expenditure decisions are reviewed and related to the current budget reform movement. The PPBS is based on the introduction of three major concepts into Federal Government operations: the development in each government agency of an analytical capability to examine in depth both agency objectives and the various programs to meet these objectives, the formation of a five-year planning and programming process coupled with a sophisticated management information system, and the creation of an improved budgeting mechanism which can take broad program decisions, translate them into more refined decisions in a budgetary context, and present the results for presidential and congressional action. The framework of the system, some long term impacts, and future prospects are also discussed. R.N.A.

N66-28006*# Minnesota Univ., Minneapolis.

AN ADMINISTRATIVE HISTORY OF NASA, 1958–1963

Robert L. Rosholt Washington, NASA, 1966 458 p refs

(Contract NASr-148)

(NASA-SP-4101) GPO: HC $4.00, CFSTI: MF $2.25 CSCL 05A

This document contains an administrative history of NASA from the years 1958 to 1963. The first five chapters cover the antecedents and first years of NASA. The last four chapters deal with the change in political administrations, the acceleration of the space program in 1961, and the organizational consequences through 1963. Five administrative themes are emphasized: organizational structure, including intra-agency relationships; administrative procedures, with emphasis on intra-agency coordination; personnel administration; finance administration; and procurement administration, especially contracting. Topics such as NASA–DOD relations and national space policy are discussed from time to time. Brief periodic summaries of NASA's program are included to help retain the context within which administrative actions were taken. Description and documentation rather than interpretation are emphasized. R.N.A.

N66-28039*# National Aeronautics and Space Administration, Washington, D. C.

BIBLIOGRAPHIES ON AEROSPACE SCIENCE—A CONTINUING BIBLIOGRAPHY WITH INDEXES, FEBRUARY 1965–APRIL 1966

Jun. 1966 100 p refs

(NASA-SP-7006(02)) CFSTI: HC $1.00/MF $0.75 CSCL 05B

An annotated bibliography is presented with abstracts, and subject and author indices. Subject areas include: astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; theoretical orbit and trajectory analyses; aerospace medicine and biology; exobiology; radiation effects on biological systems; physiological and psychological factors; aerodynamics of bodies; and wings, rotors, and control surfaces. D.T.

N66-28060# Congress. House. Committee on Science and Astronautics.

NASA AUTHORIZATION FOR 1967

Washington, GPO, 1966 159 p Index for Hearings Before Comm. on Sci. and Astronautics, 89th Congr., 2D Sess. on H. R. 12718 (Superseded by H. R. 14324), Pt. 1–4

GPO: $0.40

This document contains personal name and subject indices for hearings held before the U.S. House of Representatives Committee on Science and Astronautics on NASA authorization for 1967. R.N.A.

N66-28062# Joint Publications Research Service, Washington, D. C.

TRANSLATIONS OF COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY, NO. 321

K'ai-wei Yen, Lai-kuang Yu, and Jung-lin Ching 15 Jun. 1966 23 p refs Transl. into ENGLISH from Ch'i-Hsiang Hsueh-Pao (Peking), v. 35, no. 4, 1965 p 449–459

(JPRS-36020; TT-66-32454) CFSTI: $2.00

This article describes the structure and characteristics of translational balloons used in studying the characteristics of large scale air flow in the upper troposphere and stratosphere, and makes a preliminary analysis of clear air turbulence in the middle and lower layers of the troposphere over Peiping based on observation data of 1957 and 1958. R.N.A.

N66-28079# Library of Congress, Washington, D. C. Legislative Reference Service

POLICY PLANNING FOR AERONAUTICAL RESEARCH AND DEVELOPMENT

Washington, GPO, 1966 288 p refs Staff rept. prepared for Comm. on Aeron. and Space Sci., Senate, 89th Congr., 2d Sess. (Doc.-90) GPO: $1.00

A critical assessment is presented of the evolving technological developments which have spurred renewed interest in aeronautics both within NASA and among the aerospace industries. The report also surveys relationships of civil aviation to national transportation systems and policies; relationships between the Federal Government, industry, and the universities; and the research and development necessary to advance this technology. The existing structure within which aeronautical research and development takes place is analyzed; the sources of R and D funds and the performance of the work are identified; and the forces and existing policies which affect the nature and pace of such R and D are examined. Recent Congressional inquiry and comment are reviewed; laws and statements which constitute the basis for current policy are summarized; and issues for further Congressional consideration are delineated. Data on international aeronautical performance records are appended. M.G.J.

N66-28094# National Research Council of Canada, Ottawa (Ontario).

PUBLICATIONS OF THE DIVISION OF MECHANICAL ENGINEERING AND THE NATIONAL AERONAUTICAL ESTABLISHMENT, SERIES 2, SUPPLEMENT 1

Jan. 1966 22 p refs

CFSTI: HC $1.00/MF $0.50

Abstracts are presented for researches dealing with aeronautics and mechanical engineering, and titles are given for various feature articles from quarterly bulletins and for miscellaneous papers. M.W.R.

N66-28108# Congress. Senate. Committee on Aeronautical and Space Sciences.

NATIONAL AERONAUTICS AND SPACE ACT OF 1958, AS AMENDED, AND RELATED LEGISLATION

Washington, GPO, 31 Dec. 1965 45 p refs Staff rept. prepared for Comm. on Aeron. and Space Sci., 89th Congr., 1st Sess.

The amended National Aeronautics and Space Act of 1958 is presented, with footnotes used to indicate the changes that have been made in the original act. Summary data are also included on related legislation pertaining to procurement, executive salaries, reports to Congress on personnel hiring and practices, and the provisions of the Communications Satellite Act of 1962. The authorization and appropriation of funds to NASA are outlined, and a chart shows the amounts requested, authorized, and appropriated for fiscal years 1963–1966. Citations to the NASA authorization and appropriation acts are listed. M.G.J.

N66-28338# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).

TITLE INDEX: TACTICS AND STRATEGY, 1964 [TITELINDEX: TAKTIEK EN STRATEGIE, 1964]

[1965] 67 p refs In FRENCH, ENGLISH, GERMAN and DUTCH

(TDCK-29264) CFSTI: HC $3.00/MF $0.75

Selected bibliography of international publications on military strategy and tactics is presented. Major categories are: (1) military policy, by regions; (2) nuclear warfare; (3) strategy and tactics of land, sea, and air forces; (4) tactics of the combat arms; (5) ABC warfare; (6) military organization; and (7) communications. Transl. by K.W.

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New Jersey: Trenton
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Oklahoma: Oklahoma City
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—NATIONAL AERONAUTICS AND SPACE ACT OF 1958

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TECHNOLOGY UTILIZATION PUBLICATIONS: Information on technology used by NASA that may be of particular interest in commercial and other nonaerospace applications. Publications include Tech Briefs; Technology Utilization Reports and Notes; and Technology Surveys.

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